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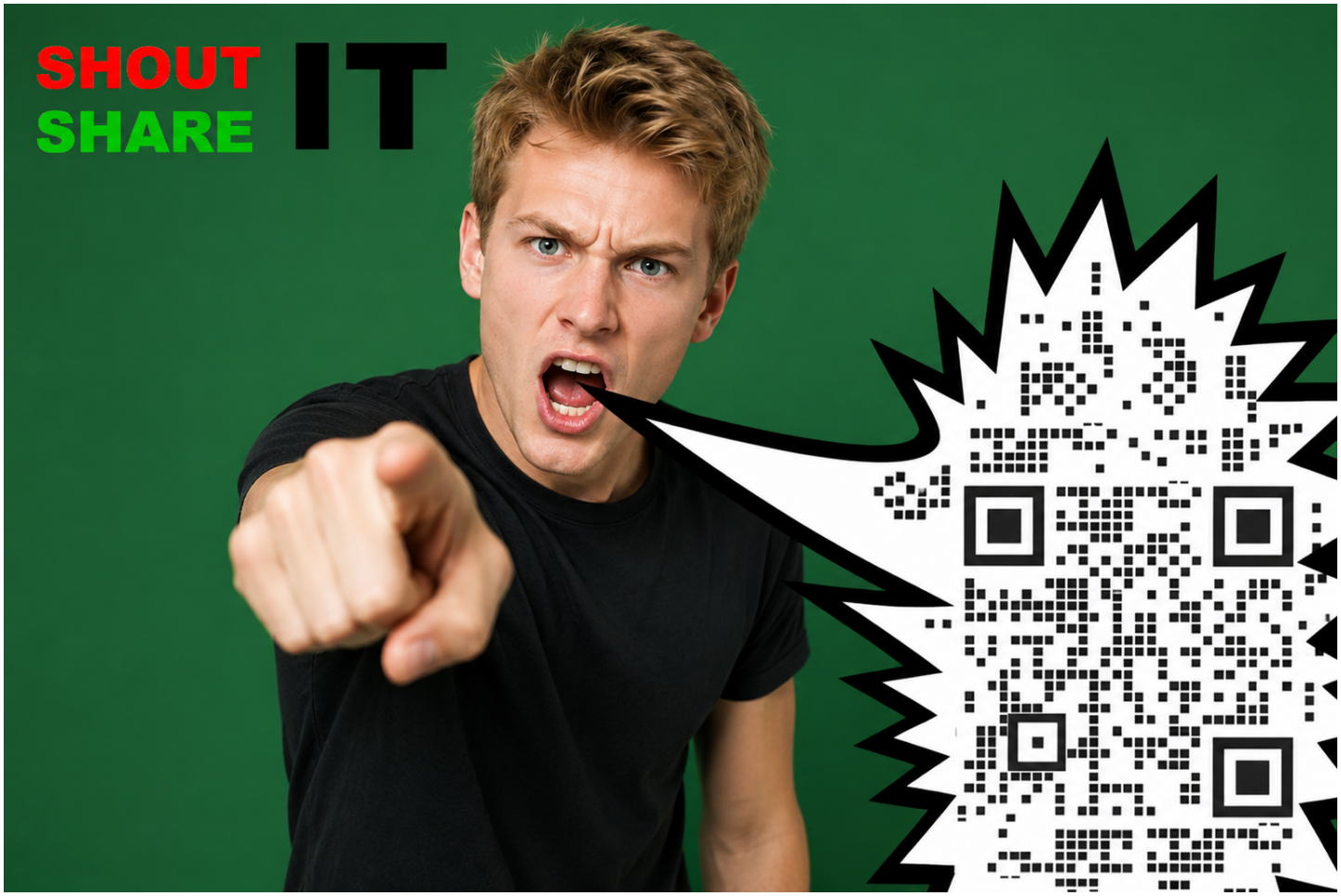
Global Forest Resources Assessment 2010

Main report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Left, top to bottom: Forest biological diversity (M.P. Wilkie); Forest health and vitality (FAO/FO-0506/C. Palmberg Lerche); Productive functions of forest resources (FAO/FO-6960/J. Carle)
Centre: Extent of forest resources (M.P. Wilkie)
Right, top to bottom: Protective functions of forest resources (M.L. Wilkie); Socio-economic functions of forests (FAO/FO-5154/Veracel); Legal, policy and institutional framework (FAO/24683_1206/G. Napolitano)

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2010

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FAO is grateful for the support of all countries, organizations and experts inside and outside the organization that have made FRA 2010 possible.

Individual contributors to the country reporting process of FRA 2010 are listed in Annex 1. Green Ink (www.greenink.co.uk) conducted the language editing, translation and layout of the report.

Foreword

Interest in the world's forests has grown to unprecedented heights, especially with growing awareness of their role in the global carbon cycle. The possibility of mitigating climate change by reducing carbon emissions caused by deforestation and forest degradation, and by increasing carbon uptake through afforestation and sustainable forest management, highlights the essential role of forests in supporting life on Earth.

But forests are more than just carbon. In 2010 we celebrate the International Year of Biodiversity, and we are reminded that forests represent some of the most diverse ecosystems on Earth. In a time of economic crisis, we are also reminded that forests provide employment and livelihoods for a large proportion of the population – especially in developing countries – and often act as an economic safety net in times of need.

FAO's Global Forest Resources Assessment (FRA), carried out at five-year intervals, provides the data and information needed to support policies, decisions and negotiations in all matters where forests and forestry play a part.

Each successive assessment is more comprehensive than the last. Organized according to the seven thematic elements of sustainable forest management, FRA 2010 contains information to monitor progress towards international goals and targets – among others the Millennium Development Goals, the 2010 Biodiversity Target of the Convention on Biological Diversity and the four Global Objectives on Forests of the Non-Legally Binding Instrument on All Types of Forests adopted by the United Nations General Assembly in January 2008. In addition, the statistics on trends in forest carbon stocks will support predictions of climate change and development of appropriate mitigation and adaptation measures.

FRA 2010 also includes information on variables such as forest health, the contribution of forests to national economies and the legal and institutional framework governing the management and use of the world's forests.

Behind the data in this report lies a well-established process of data collection, processing, validation, compilation and analysis. The participation of national experts from virtually all countries and all key international forest-related organizations ensures that the best and most recent knowledge is shared and applied, and that feedback reaches national policy processes. FAO thanks all participants for their vital collaboration.

Documentation for FRA 2010 includes 233 country reports, available online (www.fao.org/forestry/fra). Complementing the main report will be a series of special studies on topical issues as well as a global remote sensing survey of changes on forest biomes between 1990 and 2005, scheduled for completion in 2011.

The results of the present assessment are encouraging in some respects. They show that the rate of deforestation, while still alarming in many countries, is slowing down at the global level, and that afforestation and natural expansion in some countries and regions have further reduced the net loss of forests. However, most of the losses of forest happen in countries in the tropical region, while most of the gains take place in temperate and boreal zones. Furthermore, many emerging economies have moved from net loss to net gain of forest area. These results highlight the key role of economic development in reversing global deforestation.

FAO hopes that the information in this report will help broaden discussions on forests and stimulate action at all levels in the International Year of Forests (2011) and beyond.

Eduardo Rojas-Briales
Assistant Director-General, Forestry Department, FAO

Acronyms and abbreviations

CBD	Convention on Biological Diversity
COFO	Committee on Forestry (FAO)
CPF	Collaborative Partnership on Forests
FORIS	Forestry Information System (FAO)
FRA	Global Forest Resources Assessment
FTE	full time equivalent
IFF	Intergovernmental Forum on Forests
IPCC	Intergovernmental Panel on Climate Change
IPF	Ad Hoc Intergovernmental Panel on Forests
IPPC	International Plant Protection Convention
ISPM	International Standards for Phytosanitary Measures
ITTO	International Tropical Timber Organization
IUCN	International Union for Conservation of Nature
LFCC	low forest cover countries
MCPFE	Ministerial Conference on the Protection of Forests in Europe (now known as Forest Europe)
NFP	national forest programme
n.s.	not significant, indicating a very small value
NWFP	non-wood forest product
REDD	reduction in emissions from deforestation and forest degradation
SIDS	small island developing states
UNCED	United Nations Conference on Environment and Development
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
UNEP-WCMC	UNEP World Conservation Monitoring Centre
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
UNSD	United Nations Statistics Division
WRI	World Resources Institute

Executive Summary

FAO, in cooperation with its member countries, has monitored the world's forests at five to ten year intervals since 1946. These global assessments provide valuable information to policy-makers, to international negotiations, arrangements and organizations related to forests and to the general public.

The Global Forest Resources Assessment 2010 (FRA 2010) is the most comprehensive assessment to date. It examines the current status and recent trends for more than 90 variables and all types of forests in 233 countries and areas for four points in time: 1990, 2000, 2005 and 2010.

FAO worked closely with countries and forest assessment specialists in the design and implementation of FRA 2010. More than 900 contributors were involved, including 178 officially nominated national correspondents and their teams.

In the main section of this report, results are presented according to the seven thematic elements of sustainable forest management:

- extent of forest resources;
- forest biological diversity;
- forest health and vitality;
- productive functions of forest resources;
- protective functions of forest resources;
- socio-economic functions of forests;
- legal, policy and institutional framework.

A summary of key findings is presented below, followed by a section that attempts to answer the question: What does FRA 2010 tell us about progress towards sustainable forest management since 1990 at global and regional scales?

KEY FINDINGS

Forests cover 31 percent of total land area

The world's total forest area is just over 4 billion hectares, which corresponds to an average of 0.6 ha per capita (Figure 1). The five most forest-rich countries (the Russian Federation, Brazil, Canada, the United States of America and China) account for more than half of the total forest area. Ten countries or areas have no forest at all and an additional 54 have forest on less than 10 percent of their total land area (Figure 2).

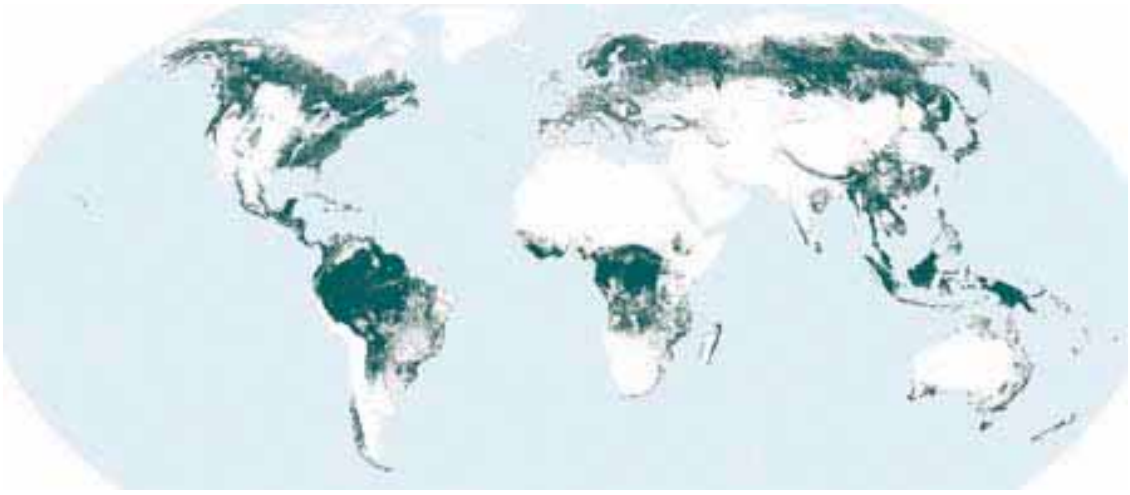
The rate of deforestation shows signs of decreasing, but is still alarmingly high

Deforestation – mainly the conversion of tropical forest to agricultural land – shows signs of decreasing in several countries but continues at a high rate in others (Boxes 1–3). Around 13 million hectares of forest were converted to other uses or lost through natural causes each year in the last decade compared with 16 million hectares per year in the 1990s. Both Brazil and Indonesia, which had the highest net loss of forest in the 1990s, have significantly reduced their rate of loss, while in Australia, severe drought and forest fires have exacerbated the loss of forest since 2000.

Large-scale planting of trees is significantly reducing the net loss of forest area globally

Afforestation and natural expansion of forests in some countries and regions have reduced the net loss of forest area significantly at the global level (Figure 4). The net change in forest area in the period 2000–2010 is estimated at -5.2 million hectares per year (an area about the size of Costa Rica), down from -8.3 million hectares per year in the period 1990–2000.

FIGURE 1
The world's forests

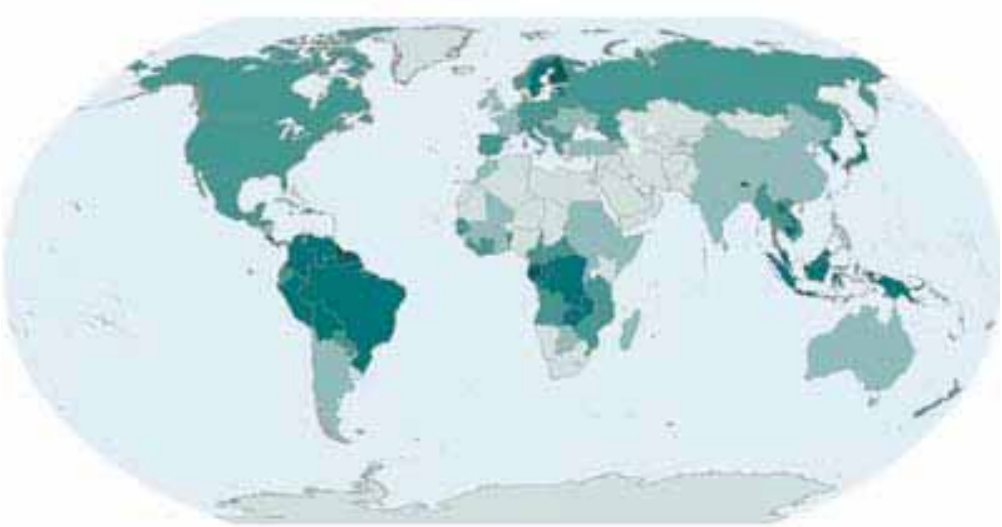


Forest (> 10 percent tree cover)
Other land
Water

Note: Tree cover derived from MODIS VCF* 250 meter pixels for year 2005.

* Moderate-resolution Imaging Spectroradiometer Vegetation Continous Fields (Hansen *et al*. 2010).

FIGURE 2
Forest area as a percentage of total land area by country, 2010



(%)

0–10
10–30
30–50
50–70
70–100
No data

BOX 1

Deforestation and net change in forest area

Figure 3 is a simplified model illustrating forest change dynamics. It has only two classes: forests and all other land. A reduction in forest area can happen through either of two processes: deforestation and natural disasters. Deforestation, which is by far the most important, implies that forests are cleared by people and the land converted to another use, such as agriculture or infrastructure. Natural disasters may also destroy forests, and when the area is incapable of regenerating naturally and no efforts are made to replant, it too converts to other land.

An increase in forest area can also happen in two ways: either through afforestation (i.e. planting of trees on land that was not previously forested) or through natural expansion of forests (e.g. on abandoned agricultural land, a process which is quite common in some European countries).

Where part of a forest is cut down but replanted (reforestation) or grows back on its own within a relatively short period (natural regeneration), there is no change in forest area.

For FRA 2010, countries were asked to provide information on their forest area for four points in time. This enables the calculation of the net change in forest area over time. This net change is the sum of all negative changes due to deforestation and natural disasters and all positive changes due to afforestation and natural expansion of forests.

FIGURE 3

Forest change dynamics

BOX 2

Previous figures underestimated the global deforestation rate for the 1990s

FRA 2010, like FRA 2005, did not directly compile data on deforestation rates because few countries have this information. In FRA 2005 the global deforestation rate was estimated from net changes in forest area. Additional information on afforestation and on natural expansion of forest for the past 20 years has now made it possible to also take into account deforestation within those countries that have had an overall net gain in forest area. As a result, the revised estimate of the global rate of deforestation and loss from natural causes for 1990–2000 (close to 16 million hectares per year) is higher, but more accurate, than was estimated in FRA 2005 (13 million hectares per year).

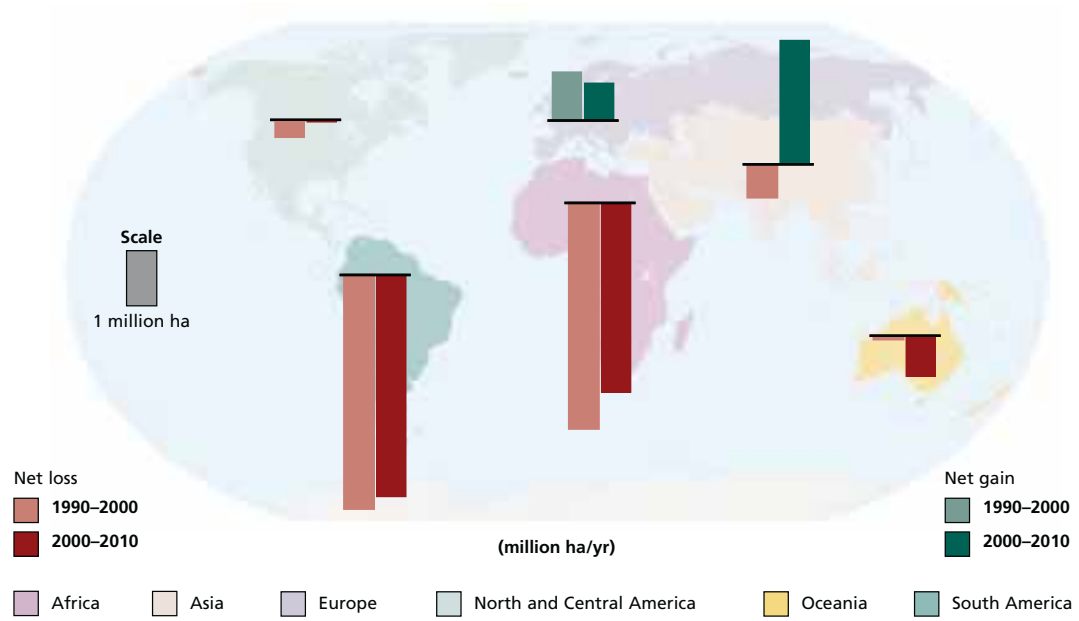
BOX 3

A global remote sensing survey of forests will yield improved information on changes in the area of major forest types over time

Countries use differing frequencies, classification systems and assessment methods when monitoring their forests, making it difficult to obtain consistent data on major forest types that span national borders. FAO, in collaboration with countries and key partner organizations, is currently undertaking a global remote sensing survey – based on a systematic sampling of some 13 500 sites around the globe – to provide additional and more consistent information on deforestation, afforestation and natural expansion of forests at regional and biome levels for the period 1990–2005. Results are expected at the end of 2011.

FIGURE 4

Annual change in forest area by region, 1990–2010



South America and Africa continue to have the largest net loss of forest

At a regional level, South America suffered the largest net loss of forests between 2000 and 2010 – about 4.0 million hectares per year – followed by Africa, which lost 3.4 million hectares annually (Figure 5). Oceania also reported a net loss of forest (about 700 000 ha per year over the period 2000–2010), mainly due to large losses of forests in Australia, where severe drought and forest fires have exacerbated the loss of forest since 2000. The area of forest in North and Central America was estimated as almost the same in 2010 as in 2000. The forest area in Europe continued to expand, although at a slower rate (700 000 ha per year) than in the 1990s (900 000 ha per year). Asia, which had a net loss of forest of some 600 000 ha annually in the 1990s, reported a net gain of forest of more than 2.2 million hectares per year in the period 2000–2010, primarily due to the large-scale afforestation reported by China and despite continued high rates of net loss in many countries in South and Southeast Asia.

FIGURE 5
Annual change in forest area by country, 2005–2010

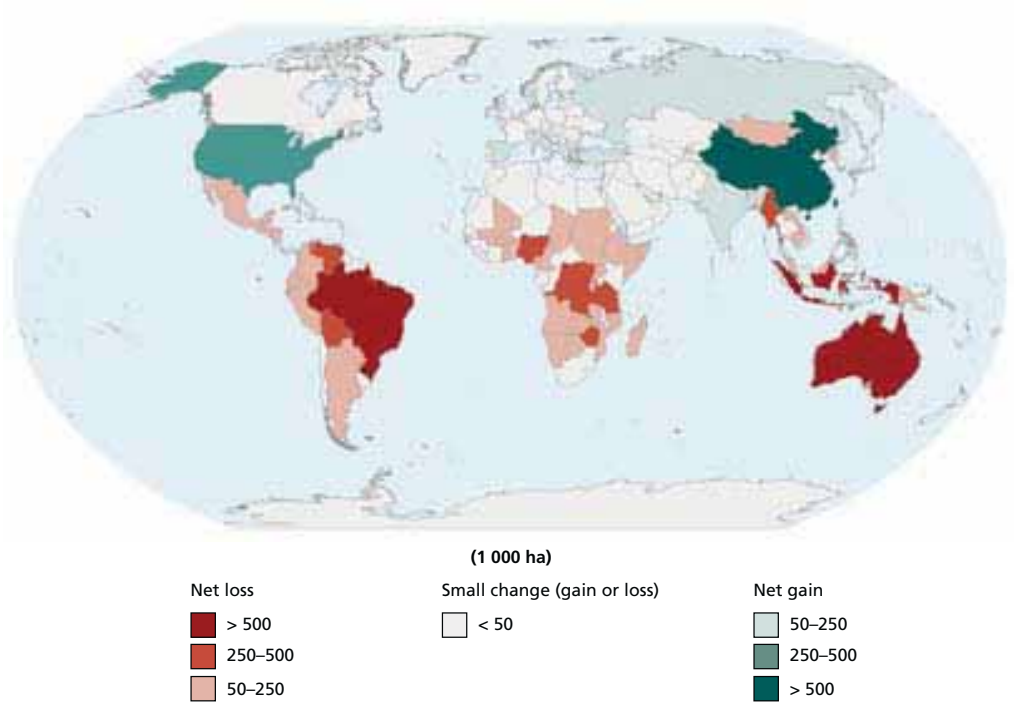
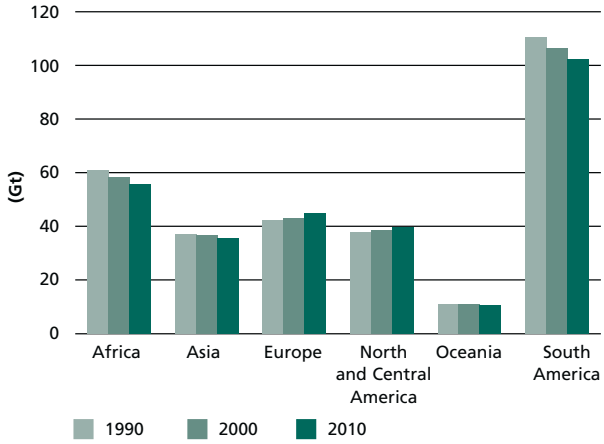


FIGURE 6
Trends in carbon stocks in forest biomass, 1990–2010



Forests store a vast amount of carbon

Estimates made for FRA 2010 show that the world's forests store 289 gigatonnes (Gt) of carbon in their biomass alone. While sustainable management, planting and rehabilitation of forests can conserve or increase forest carbon stocks, deforestation, degradation and poor forest management reduce them. For the world as a whole, carbon stocks in forest biomass decreased by an estimated 0.5 Gt annually during the period 2005–2010, mainly because of a reduction in the global forest area (Figure 6).

Primary forests account for 36 percent of forest area – but have decreased by more than 40 million hectares since 2000

On a global average, more than one-third of all forest is primary forest, i.e. forest of native species where there are no clearly visible indications of human activities and the ecological processes have not been significantly disturbed (Figure 7). Primary forests, in particular tropical moist forests, include the most species-rich, diverse terrestrial ecosystems. The decrease of primary forest area, 0.4 percent annually over a ten-year period, is largely due to reclassification of primary forest to 'other naturally regenerated forest' because of selective logging and other human interventions.

The area of planted forest is increasing and now accounts for 7 percent of total forest area

Forests and trees are planted for many purposes and make up an estimated 7 percent of the total forest area, or 264 million hectares. Between 2000 and 2010, the area of planted forest increased by about 5 million hectares per year (Figure 8). Most of this

FIGURE 7
Characteristics of the world's forests, 2010

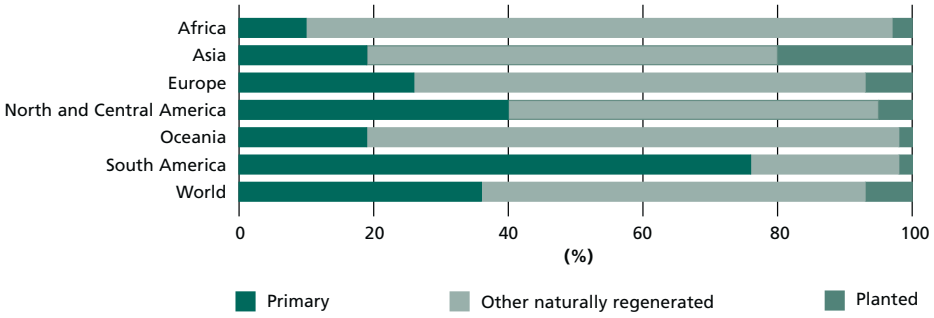
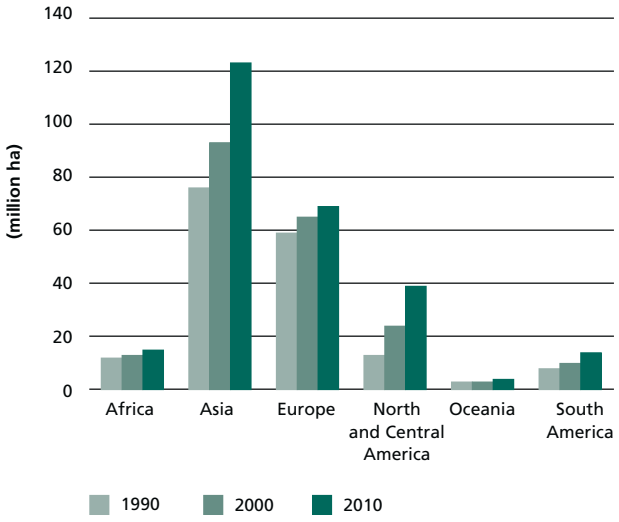


FIGURE 8
Trends in area of planted forests, 1990–2010



was established through afforestation (i.e. planting of areas not forested in recent times) particularly in China. Three-quarters of all planted forests consist of native species while one-quarter comprises introduced species (Figure 9).

Twelve percent of the world's forests are designated for the conservation of biological diversity

The area of forest where conservation of biological diversity is designated as the primary function has increased by more than 95 million hectares since 1990, of which the largest part (46 percent) was designated between 2000 and 2005 (Figure 10). These forests now account for 12 percent of the total forest area or more than 460 million hectares. Most but not all of them are located inside protected areas.

FIGURE 9
Proportion of planted forests consisting of introduced species, 2010

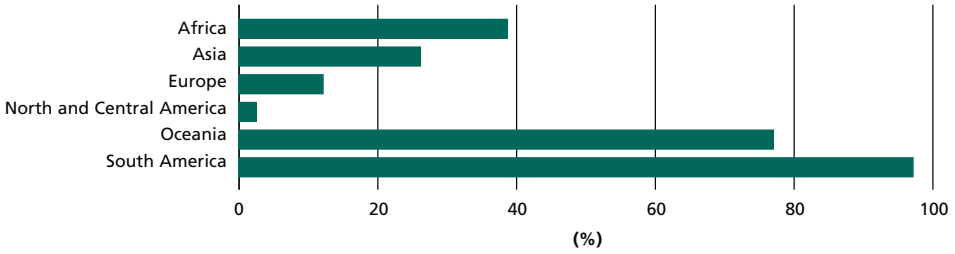
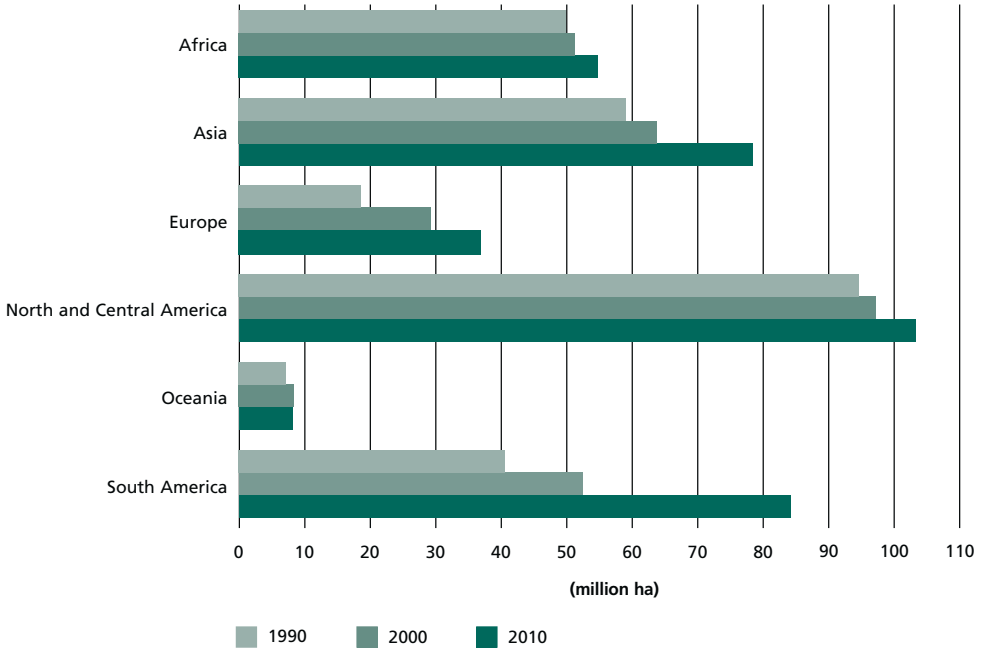


FIGURE 10
Trends in area of forest designated for conservation of biodiversity by region, 1990–2010



Legally established protected areas cover an estimated 13 percent of the world's forests

National parks, game reserves, wilderness areas and other legally established protected areas cover more than 10 percent of the total forest area in most countries and regions (Figure 11). The primary function of these forests may be the conservation of biological diversity, the protection of soil and water resources, or the conservation of cultural heritage. The area of forest within a protected area system has increased by 94 million hectares since 1990. Two-thirds of this increase has been since 2000.

Forest fires are severely underreported at the global level

While some forest ecosystems depend on fire for their regeneration, in others forest fires can be devastating and also frequently cause loss of property and human life. On average, 1 percent of all forests were reported to be significantly affected each year by forest fires. However, the area of forest affected by fires was severely underreported, with information missing from many countries, especially in Africa. Less than 10 percent of all forest fires are prescribed burning; the rest are classified as wildfires.

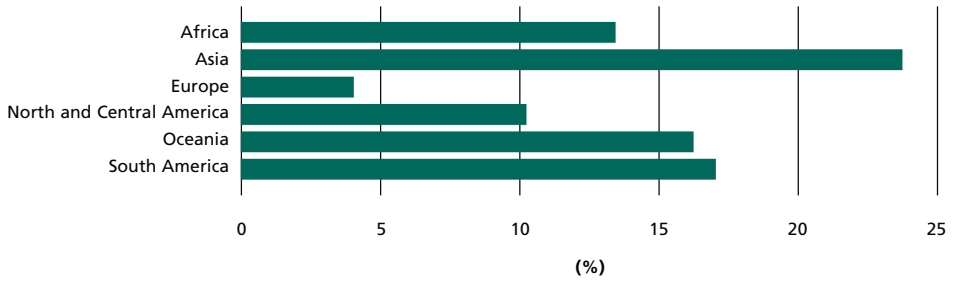
Insect pests and diseases, natural disasters and invasive species are causing severe damage in some countries

Outbreaks of forest insect pests damage some 35 million hectares of forest annually, primarily in the temperate and boreal zone. The mountain pine beetle has devastated more than 11 million hectares of forest in Canada and the western United States of America since the late 1990s – an unprecedented outbreak exacerbated by higher winter temperatures. Severe storms, blizzards and earthquakes have also damaged large areas of forest since 2000. Woody invasive species are of particular concern in small island developing states, where they threaten the habitat of endemic species. Information availability and quality continues to be poor for most of these disturbances.

Thirty percent of the world's forests are primarily used for production of wood and non-wood forest products

Close to 1.2 billion hectares of forest are managed primarily for the production of wood and non-wood forest products. An additional 949 million hectares (24 percent) are designated for multiple use – in most cases including the production of wood and non-wood forest products. The area designated primarily for productive purposes has decreased by more than 50 million hectares since 1990 as forests have been designated for other purposes. The area designated for multiple use has increased by 10 million hectares in the same period.

FIGURE 11
Percentage of forest area in protected areas by region, 2010



Wood removals increased between 2000 and 2005, following a fall in the 1990s

At the global level, reported wood removals amounted to 3.4 billion cubic metres annually in the period 2003–2007, similar to the volume recorded for 1990 and equivalent to 0.7 percent of the total growing stock (Figure 12). Considering that informally and illegally removed wood, especially woodfuel, is not usually recorded, the actual amount of wood removals is undoubtedly higher. At the global level, woodfuel accounted for about half of the removed wood.

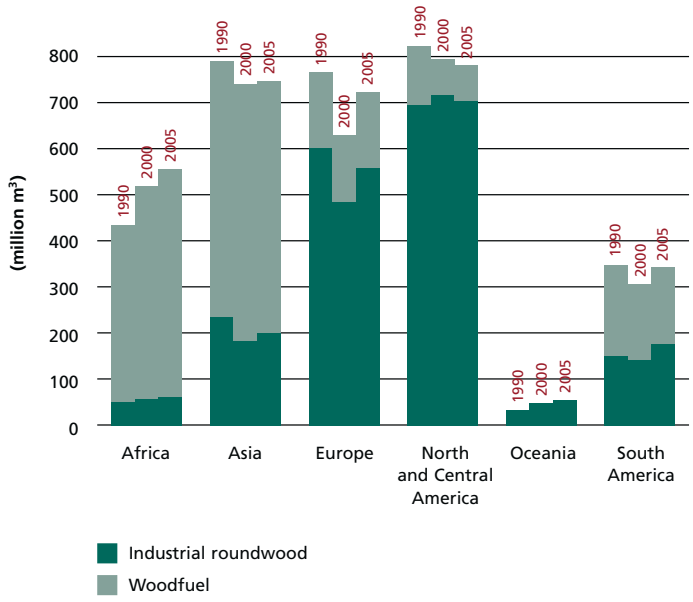
Eight percent of the world's forests have protection of soil and water resources as their primary objective

Around 330 million hectares of forest are designated for soil and water conservation, avalanche control, sand dune stabilization, desertification control or coastal protection. The area of forest designated for protective functions increased by 59 million hectares between 1990 and 2010, primarily because of large-scale planting in China aimed at desertification control, conservation of soil and water resources and other protective purposes.

The management of forests for social and cultural functions is increasing, but the area is difficult to quantify

The only subregions and regions with fairly good data on the designation of forests for recreation, tourism, education or conservation of cultural and spiritual heritage are East Asia and Europe, where provision of such social services was reported as the primary management objective for 3 and 2 percent of the total forest area, respectively. Brazil has designated more than one-fifth of its forest area for the protection of the culture and way of life of forest-dependent people. Globally, 4 percent of the world's forests are designated for the provision of social services.

FIGURE 12
Trends in wood removals, 1990–2005



The value of wood removals is high, but fluctuating

Wood removals valued just over US$100 billion annually in the period 2003–2007, mainly accounted for by industrial roundwood. At the global level the reported values show no change between 1990 and 2000, but an increase of about 5 percent annually over the period 2000–2005, suggesting that roundwood prices recovered somewhat since their decline (in real terms) in the decade 1990–2000 (Figure 13). However, they have since fallen sharply.

The value of non-wood forest products remains underestimated

The reported value of non-wood forest product removals amounted to about US$18.5 billion in 2005. Food products accounted for the greatest share. However, information is still missing from many countries in which non-wood forest products are highly important, and the true value of subsistence use is rarely captured. As a result, the reported statistics probably cover only a fraction of the true total value of harvested non-wood forest products.

Around 10 million people are employed in forest management and conservation – but many more are directly dependent on forests for their livelihoods

Reported employment in forest establishment, management and use declined by about 10 percent between 1990 and 2005, probably because of gains in labour productivity. Europe, East Asia and North America saw steep declines (15 to 40 percent between 1990 and 2005), while in other regions, employment increased somewhat – probably because roundwood production has increased faster than gains in labour productivity. Most countries reported increased employment in management of protected areas. Given that much forestry employment is outside the formal sector, forest work is surely much more important for rural livelihoods and national economies than the reported figures suggest.

Governments generally spend more on forestry than they collect in revenue

On average, total forest revenue collection was about US$4.5 per hectare, ranging from under US$1 per hectare in Africa to just over US$6 per hectare in Europe (Figure 14).

FIGURE 13
Trends in value of wood removals, 1990–2005

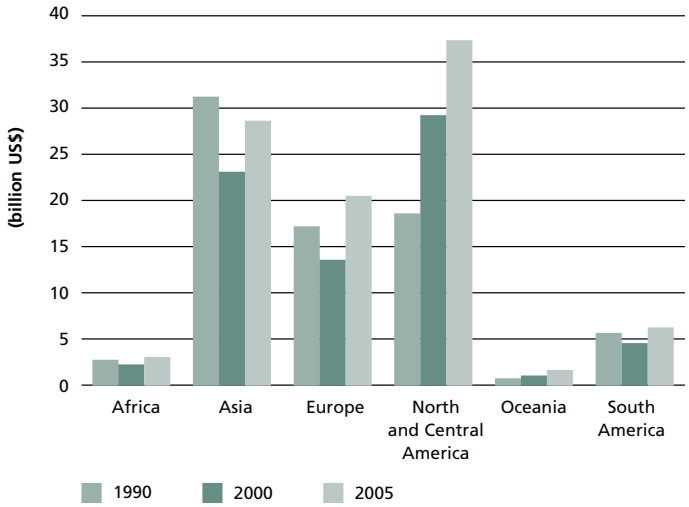
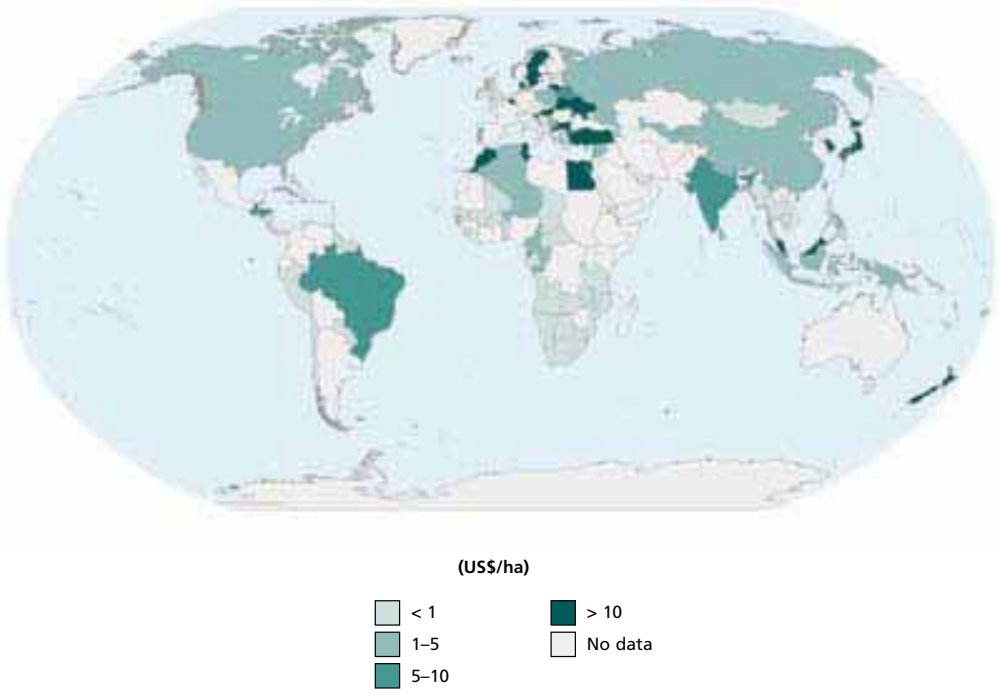


FIGURE 14
Forest revenue collection by country, 2005



Public expenditure on forestry was about US$7.5 per hectare on average. Average expenditure was highest in Asia (over US$20 per hectare). In contrast, the average expenditure per hectare was less than US$1 in South America and Oceania (Figure 15).

Significant progress has been made in developing forest policies, laws and national forest programmes

Of the 143 countries that have a forest policy statement, 76 countries have issued or updated their statements since 2000. Of the 156 countries that have a specific forest law, 69 countries – primarily in Europe and Africa – reported that their current forest law has been enacted or amended since 2005. Close to 75 percent of the world's forests are covered by a national forest programme, i.e. a participatory process for the development and implementation of forest-related policies and international commitments at the national level (Figure 16).

Staff numbers in public forest institutions are decreasing

Around 1.3 million people were reported to work in public forest institutions in 2008, 22 percent of whom were female. At the global level, the number of staff has declined by 1.2 percent annually since 2000. More than 20 000 professionals work in public forest research institutions.

The number of university students graduating in forestry is increasing

More than 60 000 university students graduate in forestry annually. This equates to about 1 per 86 000 inhabitants, or around 200 per 10 million hectares of forests. One-third of graduating students are female, and this proportion is increasing.

FIGURE 15
Public expenditure on forestry by country, 2005

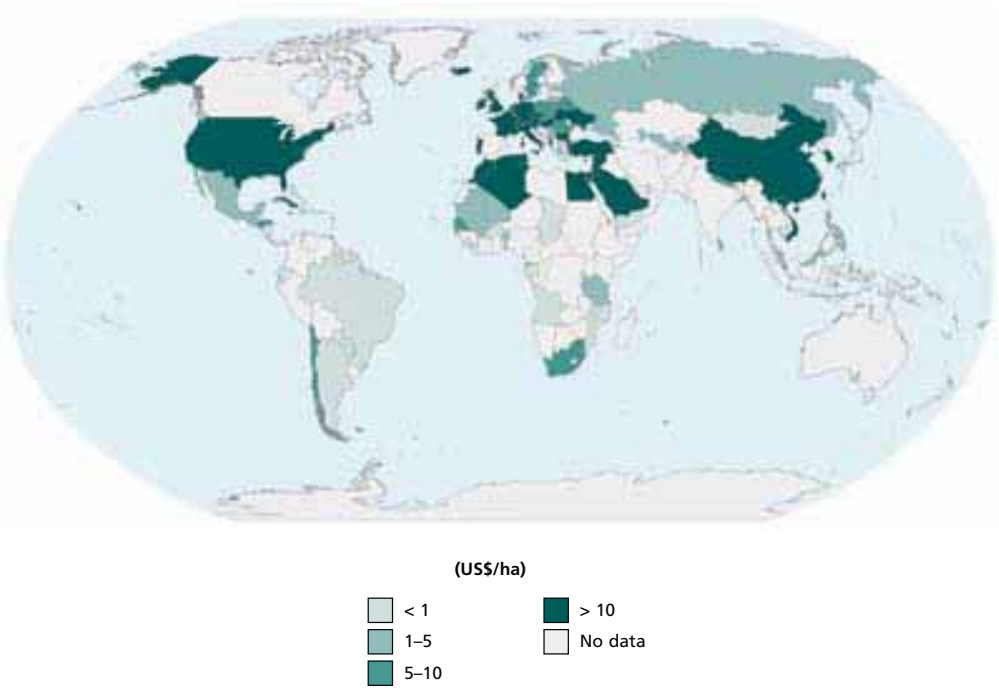
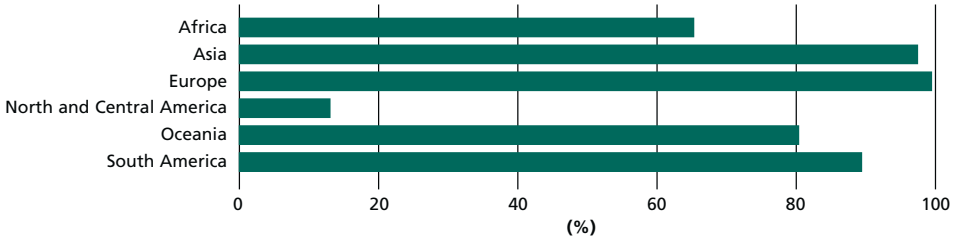


FIGURE 16
Forest area covered by a national forest programme by region, 2008



Eighty percent of the world's forests are publicly owned, but ownership and management of forests by communities, individuals and private companies is on the rise

Despite changes in forest ownership and tenure in some regions, most of the world's forests remain under public ownership (Figure 17). Differences among regions are considerable. North and Central America, Europe (other than the Russian Federation), South America and Oceania have a higher proportion of private ownership than other regions. In some regions, there is an increasing trend toward involving communities, individuals and private companies in the management of publicly owned forests (Figure 18).

FIGURE 17
Forest ownership by region, 2005

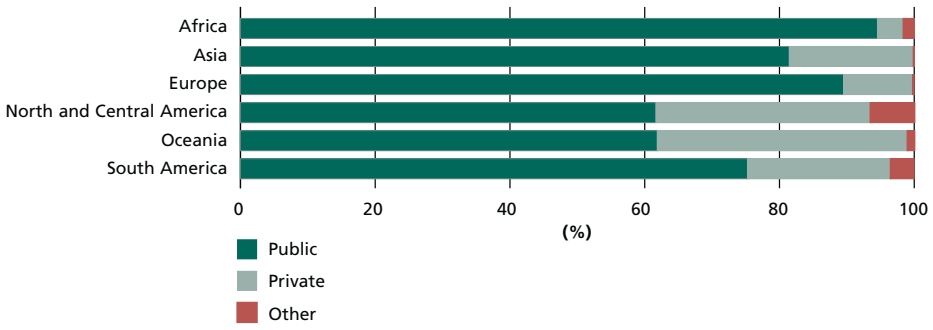
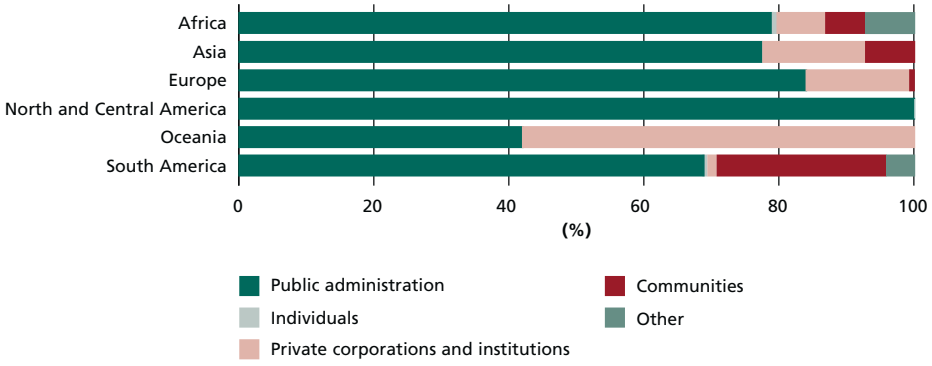


FIGURE 18
Management of public forests by region, 2005



Forests are managed for a multitude of uses and values

Forests are increasingly being conserved and managed for multiple uses and values – often in combination (Figure 19). Around 949 million hectares, or 24 percent of all forests, are designated for multiple use, i.e. managed for any combination of the production of goods, protection of soil and water, conservation of biodiversity and provision of social services – or where none of these alone is considered as the predominant function.

More than 1.6 billion hectares of forest have a management plan

The area of forest covered by a management plan – an important tool for achieving sustainable forest management – is steadily increasing, yet information is only available for 80 percent of the total forest area (Figure 20). For the first time, information was also collected on the area of forest under sustainable forest management (Box 4).

FIGURE 19
Designated functions of forests, 2010

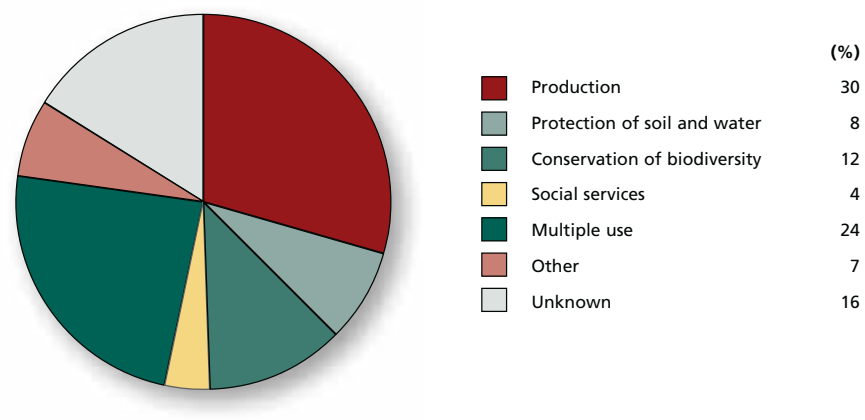
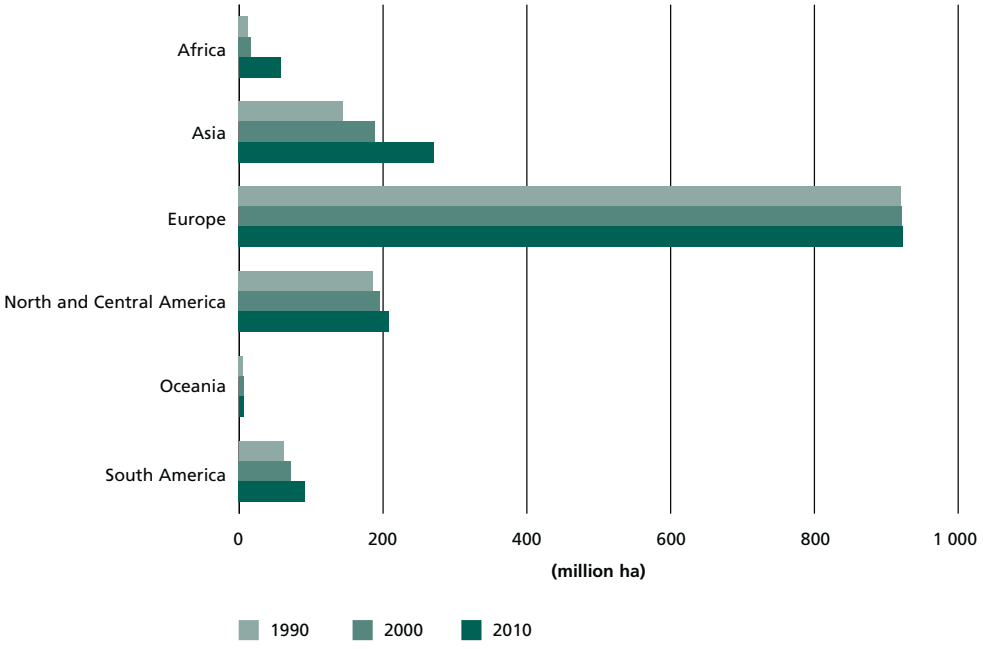


FIGURE 20
Trends in area of forest with a management plan by region, 1990–2010



PROGRESS TOWARDS SUSTAINABLE FOREST MANAGEMENT

To obtain a broad picture of progress towards sustainable forest management, a subset of indicators was selected for each of the seven thematic elements of sustainable forest management and data on trends were compiled and compared at global, regional and subregional levels across the seven themes. The results are summarized below and illustrated in Tables 1 and 2. For more information, refer to Chapter 9.

BOX 4

Information is collected on the area of forest under sustainable forest management

The area of forest with a management plan is not necessarily an adequate indicator of the area of forest under sustainable forest management. For example, plans may not be effective, or forests may be conserved and sustainably used without a plan. Therefore, for FRA 2010, countries were asked to provide information on the area of forest under sustainable management using national definitions, criteria and assessment methods, including expert estimates. More than 100 countries, representing 62 percent of the global forest area, responded. Although data cannot be compared across countries or aggregated at the global scale, the responses indicate that significant progress has been made over the last ten years.

Progress towards sustainable forest management at the global level

Overall, the situation at the global level has remained relatively stable over the last 20 years (Table 1). The change in forest area is well below the threshold of 0.5 percent per year for a significant change. The largest negative rates (in percentage terms) include the decrease in the area of primary forest over the entire 20-year period; in wood removals and employment in the 1990s; and in human resources in public forest institutions during the period 2000–2005. Significant positive trends were reported in the area of forest designated for the conservation of biological diversity and the area of forest in protected areas (particularly in the last decade), the area of planted forest and the number of students graduating in forestry. Forests under private ownership and the value of wood products showed a positive trend for the period 2000–2005.

Progress at regional levels

Africa. On the whole, progress towards sustainable forest management in Africa has improved when comparing the last decade to the 1990s. The net loss of forest area has slowed down, and the areas of forest designated for the conservation of biological diversity and included in protected areas have increased slightly. The sharp increase in the area of forest with a management plan over the last ten years is particularly good news. The continued, rapid loss of forest area (the second largest of any region during this 20-year period) is, however, still a cause for concern as is the loss of primary forests. A summary of information by subregion can be found in Table 2.

Asia. Overall the forest area in Asia is about 16 million hectares larger in 2010 than it was in 1990 as a result of large-scale afforestation efforts during the last 10–15 years, particularly in China. The decrease in area of primary forest is cause for concern, while the increase in the forest area designated for conservation of biological diversity, the area of forest in protected areas and forests designated for protective functions is commendable. The area affected by fire decreased while that affected by insects increased sharply between 1990 and 2000, but then levelled off. Variables representing the legal, policy and institutional framework are largely positive or stable and information availability in the region is generally good. In short, there has been mixed progress over the last 20 years at the regional level with large variations between countries and subregions. A summary of information by subregion can be found in Table 2.

Europe. Data availability was generally high for Europe, although results were strongly influenced by the Russian Federation. The status of forest resources in Europe

TABLE 1
Progress towards sustainable forest management at the global level, 1990–2010

Thematic element	FRA 2010 variables	Data availability	Annual change rate (%)		Annual change		
			1990–2000	2000–2010	1990–2000	2000–2010	Unit
Extent of forest resources	Area of forest	H	-0.20	-0.13	-8 323	-5 211	1 000 ha
	Growing stock of forests	H	0.13	0.14	n.s.	n.s.	m^3/ha
	Forest carbon stock in living biomass	H	-0.18	-0.17	-538	-502	million tonnes
Forest biological diversity	Area of primary forest	M	-0.40	-0.37	-4 666	-4 188	1 000 ha
	Area of forest designated primarily for conservation of biodiversity	H	1.14	1.92	3 250	6 334	1 000 ha
	Area of forest within protected areas	H	1.09	1.97	3 040	6 384	1 000 ha
Forest health and vitality	Area of forest affected by fire	M	-1.89	-2.15	-345	-338	1 000 ha
	Area of forest affected by insects	L	-1.88	-0.70	-699	-231	1 000 ha
Productive functions of forest resources	Area of forest designated primarily for production	H	-0.18	-0.25	-2 125	-2 911	1 000 ha
	Area of planted forest	H	1.90	2.09	3 688	4 925	1 000 ha
	Total wood removals	H	-0.50	1.08	-15 616	33 701	1 000 m^3
Protective functions of forest resources	Area of forest designated primarily for protection of soil and water	H	1.23	0.97	3 127	2 768	1 000 ha
Socio-economic functions of forests	Area of forest under private ownership	H	0.75	2.56	3 958	14 718	1 000 ha
	Value of total wood removals	M	-0.32	5.77	-241	4 713	million US$
	Employment in primary production of goods	M	-1.20	-0.11	-126	-10	1 000 FTE
Legal, policy and institutional framework	Forest area with management plan	M	0.51	1.07	6 964	15 716	1 000 ha
	Human resources in public forest institutions	L	-1.94	0.07	-23 568	830	total staff
	Number of students graduating in forestry	L	15.67	8.83	4 384	4 081	number of students

Notes: No forecasting to 2010 was done for areas affected by fire and by insects or for the amount and value of wood removals. For these variables estimates were provided for 1990 (an average of the period 1988–1992), 2000 (average of 1998–2002) and 2005 (average of 2003–2007). Data on ownership and employment were requested only for 1990, 2000 and 2005. In all these cases change rates were calculated for the periods 1990–2000 and 2000–2005. Data for human resources in public institutions and the number of forestry graduates are from 2000, 2005 and 2008; change rates are calculated for 2000–2005 and 2005–2008.

H = High (reporting countries represent 75–100% of total forest area)
M = Medium (reporting countries represent 50–74% of total forest area)
L = Low (reporting countries represent 25–49% of total forest area)

● = Positive change (greater than 0.50%)
● = No major change (between -0.50 and 0.50%)
● = Negative change (less than -0.50%)
– = Insufficient data to determine trend

has essentially been stable over the last 20 years. While the area of forest is expanding, the focus of forest management in Europe has clearly shifted away from productive functions towards conservation of biological diversity, protection and multiple uses – a shift already evident at the end of the 1990s. The main negative trends are found in employment and – when analysing figures excluding the Russian Federation – in human resources in public forest institutions between 2005 and 2008, as well as in the value of wood removals in the 1990s. Table 2 shows the trends for Europe including and excluding the Russian Federation.

North and Central America. Progress towards sustainable forest management was generally positive in North and Central America as a whole during the period 1990–2010, with the notable exception of the significant negative trends noted for the area of forest affected by fire and by insect pests and the slight decrease in the level of employment. There was, however, considerable variation among subregions, as can be seen in Table 2.

Oceania. Data availability is largely determined by Australia, since it accounts for 78 percent of the forest area in this region. With information missing from Australia for 1990 for many of these variables it is impossible to assess long-term trends in this region for most of the themes. The loss of primary forest and the increase in the net loss of forest area in the region are cause for concern, despite the fact that part of the loss of forest area may be a temporary loss of forest cover due to an extensive drought in Australia.

South America. Overall, progress towards sustainable forest management was mixed in South America. The rate of net forest loss continues to be a cause for concern although significant progress has been made, particularly in the last five years. The rate of loss of primary forest also remains alarmingly high. Nonetheless, there were also positive signs in the increased areas of forest designated for conservation of biological diversity and in protected areas. The decrease in removals of woodfuel may reflect a reduced demand for this product in the region, but this was partly offset by an increase in removals of industrial wood since 2000. The area of planted forests increased and may meet a larger proportion of the demand for wood in the future. The increase in the area of forest with a management plan is also a positive sign.

Is there progress towards sustainable forest management?

There are many good signs and positive trends at the global level, particularly in the last ten years, but many negative trends remain at regional, subregional and national levels. While the area of planted forest and conservation efforts are on the rise, the area of primary forests continues to decline at an alarming rate as these forests come under use or are converted to other uses. As the analyses above illustrate, the answer depends on the suite of indicators selected and the scale at which they are applied. Given this and the complexity of the question, the answer cannot be definitive.

NEXT STEPS

Members of the Collaborative Partnership on Forests (CPF), regional groups, non-governmental organizations and countries worked together in the design and implementation of FRA 2010. Joint planning for the next global assessment (FRA 2015) will commence in 2011 based on an in-depth evaluation of FRA 2010.

TABLE 2
Progress towards sustainable forest management by subregion, 1990–2010

Themes and variables	Africa									Asia		
	Eastern and Southern			Northern			Western and Central			East		
		R1	R2		R1	R2		R1	R2		R1	R2
Extent of forest resources												
Area of forest	H	●	●	H	●	●	H	●	●	H	●	●
Growing stock of forests	H	●	●	H	●	●	H	●	●	H	●	●
Forest carbon stock in living biomass	H	●	●	H	●	●	H	●	●	H	●	●
Forest biological diversity												
Area of primary forest	H	●	●	H	●	●	L	●	●	H	●	●
Area of forest designated primarily for conservation of biodiversity	H	●	●	H	●	●	M	●	●	H	●	●
Area of forest within protected areas	H	●	●	–	–	–	L	●	●	H	●	●
Forest health and vitality												
Area of forest affected by fire	L	●	●	–	–	–	–	–	–	H	●	●
Area of forest affected by insects	–	–	–	–	–	–	–	–	–	H	●	●
Productive functions of forest resources												
Area of forest designated primarily for production	H	●	●	H	●	●	M	●	●	H	●	●
Area of planted forest	H	●	●	H	●	●	H	●	●	H	●	●
Total wood removals	H	●	●	H	●	●	H	●	●	H	●	●
Protective functions of forest resources												
Area of forest designated primarily for protection of soil and water	H	●	●	H	●	●	M	●	●	H	●	●
Socio-economic functions of forests												
Area of forest under private ownership	H	●	●	H	●	●	H	●	●	H	●	●
Value of total wood removals	–	–	–	H	●	●	L	●	●	H	●	●
Employment in primary production of goods	L	●	●	–	–	–	–	–	–	H	●	●
Legal, policy and institutional framework												
Forest area with management plan	M	●	●	–	–	–	L	●	●	H	●	●
Human resources in public forest institutions	H	●	●	H	●	●	L	●	●	H	●	●
Number of students graduating in forestry	M	●	●	H	●	●	L	●	●	H	●	●

Notes:
R1 = Reference period 1: 1990–2000 with a few exceptions, see Notes to Table 1
R2 = Reference period 1: 2000–2010 with a few exceptions, see Notes to Table 1

H = High (reporting countries represent 75–100% of total forest area)
M = Medium (reporting countries represent 50–74% of total forest area)
L = Low (reporting countries represent 25–49% of total forest area)

● = Positive change (greater than 0.50%)
● = No major change (between -0.50 and 0.50%)
● = Negative change (less than -0.50%)
– = Insufficient data to determine trend

Asia						Europe					North and Central America							Oceania			South America		
South and Southeast			Western and Central			Total Europe			Europe excl. Russian Federation			Caribbean			Central America			North America						
	R1	R2		R1	R2		R1	R2		R1	R2		R1	R2		R1	R2		R1	R2		R1	R2		R1	R2
H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	–	–	–	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	–	–	–	H	●	●
H	●	●	H	●	●	–	–	–	M	●	●	M	●	●	H	●	●	H	●	●	H	●	●	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	–	–	–	H	●	●
H	●	●	L	●	●	H	●	●	H	●	●	L	●	●	–	–	–	H	●	●	–	–	–	M	●	●
H	●	●	L	●	●	H	●	●	H	●	●	M	●	●	–	–	–	H	●	●	–	–	–	–	–	–
–	–	–	L	●	●	H	●	●	M	●	●	–	–	–	–	–	–	H	●	●	–	–	–	–	–	–
H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	H	●	●	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	H	●	●	H	●	●	H	●	●	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	H	●	●	H	●	●	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	–	–	–	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	–	–	–	H	●	●
M	●	●	M	●	●	–	–	–	H	●	●	L	●	●	–	–	–	H	●	●	–	–	–	M	●	●
L	●	●	M	●	●	H	●	●	M	●	●	–	–	–	L	●	●	L	●	●	H	●	●	–	–	–
L	●	●	L	●	●	H	●	●	H	●	●	L	●	●	–	–	–	L	●	●	–	–	–	M	●	●
M	●	●	L	●	●	–	–	–	M	●	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
L	●	●	L	●	●	–	–	–	M	●	●	L	●	●	L	●	●	M	●	●	–	–	–	H	●	●

Chapter 1

Introduction

Global forest resources assessments, coordinated by FAO, have been made at five to ten year intervals since FAO was established in 1945.[1] The mandate for these assessments is found in the FAO Constitution, which states that "The Organization shall collect, analyse, interpret and disseminate information relating to nutrition, food and agriculture. In this Constitution, the term 'agriculture' and its derivatives include fisheries, marine products, forestry and primary forestry products." (Article I, Functions of the Organization, paragraph 1) (FAO, 2000).

The Global Forest Resources Assessment 2010 (FRA 2010) was requested by FAO member countries during the eighteenth session of the FAO Committee on Forestry (COFO) in March 2007 (FAO, 2007a). It is the most comprehensive assessment to date, both in terms of content and contributors. More than 900 people have been involved in the country reporting process alone, including 178 national correspondents and their teams, an advisory group, international experts, FAO staff, consultants and volunteers from around the world.

The scope and content of the global assessments have evolved over time to respond to changing information needs. The main concern driving the first FAO-led assessment was well expressed in the first sentence of its report: "The whole world is suffering from shortages of forest products" (FAO, 1948). Studies of timber supply trends dominated FRAs through the 1960s. From the 1970s through FRA 1990 environmental dimensions of forest resources were in focus, in particular the rate of deforestation. FRA 2000 was designed to cover a wider range of forest benefits and functions, but severe information shortages made reporting on key trends difficult. In addition, users and the media still appeared to be primarily interested in forest area and area change (Holmgren and Persson, 2002).

The reporting framework for FRA 2005 was based on the concept of sustainable forest management, encompassing social, economic and environmental dimensions of forest resources. Further, the FRA 2005 process involved countries to a much higher degree than previous assessments, leading to a higher response rate and quality control of information at the national level.

FRA 2010 continued this broader, more participatory approach and, for the first time, covered the legal, policy and institutional framework guiding forests and their management and use. Close collaboration with other reporting processes sought to avoid duplication of effort for variables that are reported to several agencies. For example, further streamlining of reporting to FAO and to the International Tropical Timber Organization (ITTO) and the Ministerial Conference for the Protection of Forests in Europe (now Forests Europe) was achieved; new variables were included in FRA 2010 to enable the assessment of progress towards the 2010 Biodiversity Target of the Convention on Biological Diversity (CBD) and towards the four Global Objectives on Forests of the Non-legally Binding Instrument on all Types of Forests adopted by the United Nations General Assembly at its 62nd Session (UNGA, 2008); and methods for reporting on variables related to forest biomass and carbon were harmonized with the latest specifications and guidelines of the Intergovernmental Panel on Climate

[1] The reporting years have been as follows: 1946–1948, 1953, 1958, 1963, mid-1970s (regional assessments), 1980, 1988, 1990, 1995, 2000 and 2005.

Change (IPCC, 2006). The proportion of land area under forests, reported to FAO as part of FRA 2010, is also used as one of the indicators of progress in reaching the Millennium Development Goals (United Nations, 2008). Efforts have continued to establish and maintain globally consistent definitions in the FRA process, in order to ensure consistency over time and reduce the overall reporting burden on countries.

The present report provides a comprehensive overview of the results of FRA 2010 grouped according to seven themes, covering key aspects of sustainable forest management:

- Extent of forest resources
- Forest biological diversity
- Forest health and vitality
- Protective functions of forest resources
- Productive functions of forest resources
- Socio-economic functions of forests
- Legal, policy and institutional framework

In each chapter, an overview provides an introduction to the theme including a list of the relevant variables included in FRA 2010, key findings and the main conclusions. This is then followed by separate sections for each of the variables, highlighting the availability of information, current status and trends.

In Chapter 9, an attempt is made to synthesize the results and highlight key trends that illustrate progress towards sustainable forest management at subregional, regional and global levels.

Chapter 10 offers the main conclusions of the FRA 2010 reporting process and its results. This chapter is followed by the bibliography and annexes providing country statistics and other background material.

More information on the content and structure of the report and on the FRA 2010 process is provided below.

THE REPORTING FRAMEWORK

Sustainable forest management and FRA 2010

The term 'sustainable forest management' can be traced to the non-binding 'Forest Principles' and Chapter 11 of Agenda 21, which were prominent outputs of the United Nations Conference on Environment and Development (UNCED) in June 1992.

The guiding objective of the Forest Principles is to contribute to the management, conservation and sustainable development of all types of forests and to provide for their multiple and complementary functions and uses. Principle 2b specifically states, "Forest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural and spiritual needs of present and future generations."

The concept of sustainable forest management dates back much further and has continued to evolve since 1992 through international forest policy dialogue within the Intergovernmental Panel on Forests (IPF), the Intergovernmental Forum on Forests (IFF) and the United Nations Forum on Forests (UNFF) – and through a large number of country-led and ecoregional initiatives aimed at translating the concept into practice. These include the development of criteria and indicators of sustainable forest management supported by international organizations including FAO, the International Tropical Timber Organization (ITTO), the United Nations Environment Programme (UNEP) and other members of the Collaborative Partnership on Forests (CPF).

Sustainable management of forests and trees is also the strategic objective of the FAO Strategy for Forests and Forestry (FAO, 2010a).

Despite, or perhaps because of, the long maturation process of the sustainable forest management concept, it is difficult to explicitly define sustainable forest management. The Non-legally Binding Instrument on all Types of Forests, the most

recent agreement related to forests, lists the following seven thematic elements of sustainable forest management and suggests that member states should consider these as a reference framework:

1. Extent of forest resources
2. Forest biological diversity
3. Forest health and vitality
4. Productive functions of forest resources
5. Protective functions of forest resources
6. Socio-economic functions of forests
7. Legal, policy and institutional framework

FRA 2005 covered the first six of these thematic elements. Following an evaluation of FRA 2005, the fifth Expert Meeting on Global Forest Resources Assessments, held in Kotka, Finland in 2006 (Kotka V), recommended that the FRA process should continue to use the sustainable forest management concept as a reporting framework and that FRA 2010 should cover all seven thematic elements.

The participants at this Expert Consultation also recommended that FRA 2010 should (FAO 2006a):

- employ 1990, 2000 and 2010 as the main reporting years;
- provide the forest-related information needed for the assessment of progress towards the 2010 biodiversity target of the CBD;
- use country reports submitted by individual countries as the basis;
- include a remote sensing component as a complementary part of FRA 2010. It should provide information on the spatial distribution of forests and forest land cover, and land-use change dynamics, such as deforestation, afforestation and natural expansion of forests, at the biome, regional and global level;
- maintain and strengthen the network of national correspondents, including support to regional networks. Collaboration among focal points for various forest-related reporting processes within countries should be encouraged;
- maintain and enhance collaboration with forest-related organizations, e.g. members of the CPF, criteria and indicator processes and the remote sensing community with a view to pooling resources and expertise and reducing the reporting burden on countries;
- provide a global platform for reporting on core, quality-controlled information on forest resources, which can be used by a wide range of international and national processes and which can contribute to an assessment of progress towards sustainable forest management.

At its 18th session, COFO reviewed the Global Forest Resources Assessment 2005 and recognized the considerable progress that had been made in harmonizing national information in a global synthesis and in using a participatory process. The Committee recommended that FAO continue to collaborate with Members, CPF members, and regional partners in global forest resources assessments. It also endorsed the recommendations of the International Expert Consultation on Forest Resources Assessments (Kotka V) as a basis for FRA 2010. The Committee further requested that FRA 2010 should fully reflect the four Global Objectives on Forests (see Box 1.1).

Based on this guidance, the reporting tables for FRA 2010 were developed in collaboration with the FRA advisory group and national correspondents.

THE SCOPE OF FRA 2010

FRA 2010 reporting tables

Seventeen reporting tables were developed to address the thematic elements of sustainable forest management (Table 1.1). The tables, including variables and definitions, were subject to intensive review by the FRA advisory group and national correspondents. Detailed specifications of the tables, variables and definitions, as well

BOX 1.1

The Global Objectives on Forests

Global Objective 1
Reverse the loss of forest cover worldwide through sustainable forest management, including protection, restoration, afforestation and reforestation, and increase efforts to prevent forest degradation.

Global Objective 2
Enhance forest-based economic, social and environmental benefits, including by improving the livelihoods of forest-dependent people.

Global Objective 3
Increase significantly the area of protected forests worldwide and other areas of sustainably managed forests, as well as the proportion of forest products from sustainably managed forests.

Global Objective 4
Reverse the decline in official development assistance for sustainable forest management and mobilize significantly increased, new and additional financial resources from all sources for the implementation of sustainable forest management.

As part of UNGA resolution 62/419 Member States reaffirmed their commitment to work globally, regionally and nationally to achieve progress towards the achievement of these four objectives by 2015.

Source: UNGA, 2008

TABLE 1.1
FRA 2010 reporting tables and links to the thematic elements of sustainable forest management

	Thematic elements						
Reporting table	Extent of forest resources	Forest biological diversity	Forest health and vitality	Productive functions of forest resources	Protective functions of forest resources	Socio-economic functions of forests	Legal, policy and institutional framework
1. Extent of forest and other wooded land	✓	✓		✓			
2. Forest ownership and management rights						✓	✓
3. Forest designation and management		✓		✓	✓	✓	✓
4. Forest characteristics	✓	✓		✓	✓		
5. Forest establishment and reforestation	✓	✓		✓			
6. Growing stock	✓	✓	✓	✓			
7. Biomass stock	✓	✓		✓			
8. Carbon stock	✓			✓			
9. Forest fires	✓	✓	✓	✓	✓		
10. Other disturbances affecting forest health and vitality	✓	✓	✓	✓	✓		
11. Wood removals and value of removals				✓		✓	
12. Non-wood forest products removals and value of removals				✓		✓	
13. Employment						✓	
14. Policy and legal framework							✓
15. Institutional framework							✓
16. Education and research							✓
17. Public revenue collection and expenditure						✓	

as the guidelines for reporting, are available online in English, French, Spanish, Arabic and Russian (FAO, 2007b,c,d). Countries were asked to provide information for the 17 tables for four points in time: 1990, 2000, 2005 and 2010 (with the exception of a few variables for which forecasting to 2010 was inappropriate).

Countries and areas included in FRA 2010

A total of 233 countries and areas are included in FRA 2010. This is based on the list used by the United Nations Statistics Division (UNSD) (United Nations, 2010a). Four reporting units included in the UNSD list were excluded from FRA 2010:

1. Aaland Islands (included under Finland);
2. Hong Kong Special Administrative Region of China (included under China);
3. Macao Special Administrative Region of China (included under China);
4. Channel Islands (listed separately as Guernsey and Jersey in FRA 2010).

Compared with FRA 2005, four reporting units were excluded from FRA 2010 (British Indian Ocean Territory, Channel Islands, Serbia and Montenegro, and South Georgia and the South Sandwich Islands) and eight were added (Guernsey, Jersey, Montenegro, Norfolk Islands, Saint Barthélemy, Saint Martin (French part), Serbia, and Svalbard and Jan Mayen Islands).

For each of the 233 countries and areas a country report has been prepared and issued as an FRA 2010 working paper.

Regions and subregions

Reporting for FRA 2010 is broken down into six regions. These regions are the same as those used in other FAO publications, including FRA 2005, and follow well-established delineations. However, because of the difference in size of individual countries, this breakdown means that the results in some regions are dominated by one or a few countries. The Russian Federation is included in Europe and dominates those statistics; the Caribbean and Central America are combined with North America and tend to be overshadowed by Canada and the United States of America; Brazil dominates the regional results from South America, and Australia those from Oceania.

A further breakdown was created to provide more detail for three of the regions: Africa, Asia, and North and Central America. Each of these regions is divided into three subregions, bringing the total number of reporting groups to 12.[2] The subregional divisions are somewhat arbitrary, but are intended to represent areas with similar environmental and socio-economic conditions. Table 1.2 summarizes key statistics for the regions and subregions, and Figure 1.1 provides a graphic illustration of the countries included in each.

THE PROCESS

FRA 2010 started with the Kotka V Expert Consultation on Global Forest Resources Assessments in June 2006 (FAO, 2006a) and so far has taken four years to implement (Figure 1.2). The outputs include the release of the key findings and the 233 reports (March 2010) and the launch of the present report in October 2010. The results of the global remote sensing survey and the special studies will be released during 2011.

FRA 2010 was coordinated by the Global Forest Assessment and Reporting Team at FAO headquarters in Rome. Six staff members, including project and administrative staff, were engaged full time throughout the country reporting process and acted as focal points for each region in order to facilitate communications between the national correspondents and FAO.

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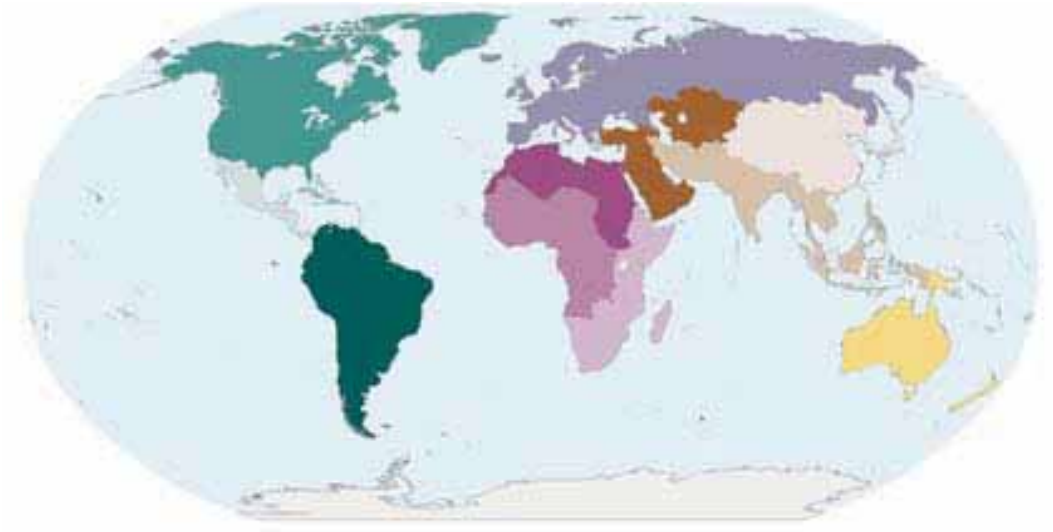
[2] In some instances, the value for the Russian Federation differs substantially from that for the rest of Europe. In these cases the results for 'Europe excluding the Russian Federation' are shown separately from results for Europe as a whole in order to highlight the variation in the region.

TABLE 1.2
Key statistics for regions and subregions used in FRA 2010

Region/subregion	Number of countries and areas	Land area (million hectares)	Population 2008			
			Total (million)	Annual growth rate (%)	Density (population/ km²)	Rural (% of total)
Eastern and Southern Africa	23	1 000	368	2.4	37	69
Northern Africa	8	941	209	1.7	22	49
Western and Central Africa	26	1 033	410	2.6	40	59
Total Africa	**57**	**2 974**	**987**	**2.3**	**33**	**61**
East Asia	5	1 158	1 547	0.5	134	53
South and Southeast Asia	18	847	2 144	1.4	253	66
Western and Central Asia	25	1 086	385	1.8	35	40
Total Asia	**48**	**3 091**	**4 075**	**1.1**	**132**	**59**
Total Europe	**50**	**2 215**	**732**	**0.1**	**33**	**28**
Caribbean	27	23	42	0.8	182	34
Central America	7	51	41	1.7	80	45
North America	5	2 061	454	1.0	22	19
Total North and Central America	**39**	**2 135**	**536**	**1.0**	**25**	**23**
Total Oceania	**25**	**849**	**35**	**1.3**	**4**	**30**
Total South America	**14**	**1 746**	**385**	**1.2**	**22**	**17**
World	**233**	**13 011**	**6 751**	**1.2**	**52**	**50**

FIGURE 1.1
Regional and subregional breakdown used in FRA 2010



Africa
- Northern Africa
- Western and Central Africa
- Eastern and Southern Africa

Asia
- East Asia
- South and Southeast Asia
- Western and Central Asia

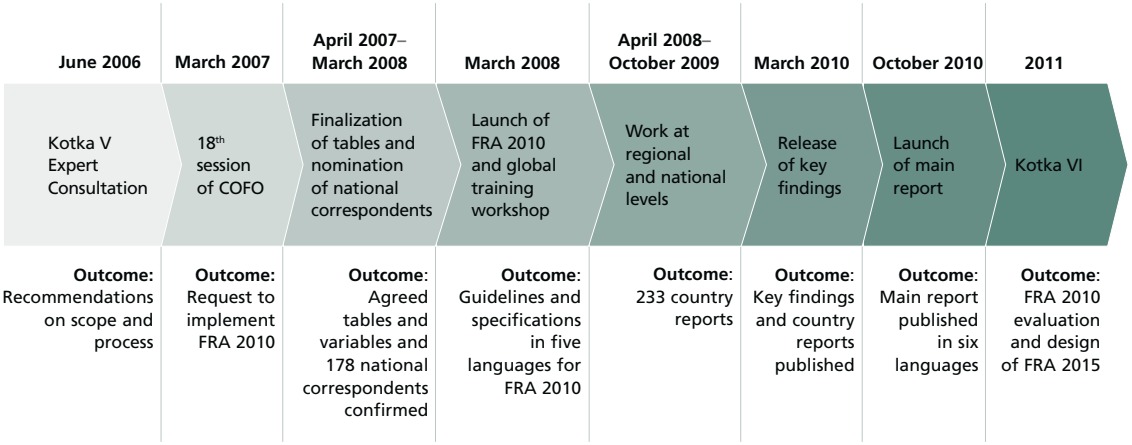
Europe

North and Central America
- Caribbean
- Central America
- North America

Oceania

South America

FIGURE 1.2
FRA 2010 timeline


June 2006
March 2007
April 2007–March 2008
March 2008
April 2008–October 2009
March 2010
October 2010
2011
Kotka V Expert Consultation
18th session of COFO
Finalization of tables and nomination of national correspondents
Launch of FRA 2010 and global training workshop
Work at regional and national levels
Release of key findings
Launch of main report
Kotka VI
Outcome: Recommendations on scope and process
Outcome: Request to implement FRA 2010
Outcome: Agreed tables and variables and 178 national correspondents confirmed
Outcome: Guidelines and specifications in five languages for FRA 2010
Outcome: 233 country reports
Outcome: Key findings and country reports published
Outcome: Main report published in six languages
Outcome: FRA 2010 evaluation and design of FRA 2015

Besides the core staff, a large number of FAO staff, consultants and volunteers were engaged in various phases of FRA 2010 as specialists within specific subjects, as assistants in the preparation of reports for countries and areas without a national correspondent and as regional staff in decentralized offices. The United Nations Economic Commission for Europe/FAO Timber Section (now UNECE/FAO Forestry and Timber Section) in Geneva was a key institutional partner, handling communications and support to several countries in Europe and Central Asia.

An FRA advisory group provided guidance and support throughout the process. Members of the group represent partner institutions, including ITTO, the Ministerial Conference for the Protection of Forests in Europe (MCPFE – now known as Forest Europe), representatives from the secretariats of CBD and UNFCCC, the UNEP World Conservation Monitoring Centre (UNEP–WCMC), the International Union for Conservation of Nature (IUCN) and the World Resources Institute (WRI), as well as a range of countries from all regions (See Annex 1 for the full list of members). The advisory group has been instrumental in the development of FRA 2010, as well as fulfilling a valuable oversight and review function.

In line with recommendations from Kotka V and COFO 2007, FAO requested countries to officially nominate a national correspondent to the FRA 2010 process. The response to this request has been very strong from practically all countries. At present, 178 national correspondents are confirmed. These correspondents, and their respective professional networks in the countries, represent a tremendous strength of the FRA 2010 process, and were responsible for coordinating inputs and preparing country reports according to a standard format in English, French or Spanish. A training session, attended by 265 forest assessment specialists, including representatives from 154 countries and 14 key forest-related organizations, was held in March 2008 in Rome, and detailed guidelines, specifications and reporting formats were provided.

The reporting format required countries to provide the full reference for original data sources and an indication of the reliability of the data for each of these, as well as definitions of terminology. Separate sections in these reports deal with analysis of data, including any assumptions made and the methodologies used for estimations and projections of data to the four reference years (1990, 2000, 2005 and 2010); calibration of data to the official land area as held by FAO; and reclassification of data to the classes used in FRA 2010. Comments attached to the tables yield additional information,

particularly where countries have experienced difficulty in matching national classes to those used in FRA 2010.

Regional focal points at FAO headquarters and its regional and subregional offices were in regular contact with national correspondents throughout the process. A list of frequently asked questions were provided on the FRA 2010 web site to further facilitate the reporting process.

Once received, the draft country reports underwent detailed reviews to ensure completeness and correct application of definitions and methodologies – including the reclassification of national data into the FRA 2010 classification system. Internal consistency was checked and a comparison made with information provided for FRA 2005, the FAO/UNECE/ITTO/Eurostat Joint Forest Sector Questionnaire and other published sources of information.

A total of ten regional and subregional workshops were held to review the draft reports (see Annex 5 for details). These workshops provided an opportunity to share experiences and to address specific questions and issues related to data availability and interpretation. The final reports are thus the result of an iterative process and a collaborative effort.

The data were then entered into FAO's Forestry Information System (FORIS) and global tables were generated. Subject specialists at FAO analysed these tables and prepared subregional, regional and global overviews for each topic of the main report. Before publishing the key findings and the global tables, all country reports were sent to the head of forestry in the respective country for final validation.

THE OUTPUTS

In addition to the present report, other major outputs of FRA 2010 include:

- ***Country reports***. A total of 233 detailed reports have been prepared, listing the data sources and original data, and describing the methodologies used for estimation, forecasting and reclassification, as well as any assumptions made. These reports are available on the FAO Forestry web site (www.fao.org/forestry/fra2010) in English, French or Spanish. Hard copies are available upon request.
- ***An interactive database.*** All data have been entered into a database and a user interface has been deployed for easy retrieval of these statistics. Available on the FAO Forestry web site.
- ***Global tables***. A set of 40 global tables have been compiled based on the information provided by the countries. Twenty of these can be found in Annex 3 and the full set is available on the FAO Forestry web site.
- ***Key findings***. The key findings of FRA 2010 were released in March 2010 (FAO, 2010a). A flyer describing these is available in English, French, Spanish, Arabic, Chinese and Russian on the FAO web site or in hard copy upon request.
- ***A global remote sensing survey***. Together with key partner organizations and with the involvement of remote sensing specialists in around 150 countries, a global remote sensing survey of forests is being carried out as part of FRA 2010. Results are expected at the end of 2011. Box 2.3 in Chapter 2 describes this survey in greater detail.
- ***Special studies***. A number of thematic studies provide complementary information on specific topics: forest degradation; trees outside forests; forests, poverty and livelihoods; forest genetic resources; and forests and forestry in small islands. Each of these studies involves additional specialists and will be published separately.
- ***Working papers***. A number of FRA working papers have been prepared as part of the FRA 2010 process. They can be found at http://www.fao.org/forestry/fra/2560/en/ and are listed in Annex 4.

Chapter 2

Extent of forest resources

OVERVIEW

The extent of forest resources is the first measure of sustainable forest management. It relates to the overall goal of maintaining adequate forest resources – of various forest types and characteristics, including other wooded land and trees outside forests – to support the social, economic and environmental objectives related to forests and forestry within a country or region. The aim of monitoring the extent and characteristics of forest resources is to understand and reduce unplanned deforestation, restore and rehabilitate degraded forest landscapes, evaluate the important function of carbon sequestration by forests, other wooded lands and trees outside forests, and designate forests for different purposes.

Information on the extent of forest resources has formed the backbone of all global forest resources assessments and continued to be a major topic in FRA 2010. Forest area is an easily understood baseline variable, which provides a first indication of the relative importance of forests in a country or region. Estimates of change in forest area over time provide an indication of the demand for land for forestry and other land uses. The proportion of land area under forests is used as one of the indicators for the Millennium Development Goals (United Nations, 2008), and information on trends in the area of forest is used to assess progress towards the 2010 Biodiversity Target of the CBD, as well as the Global Objectives on Forests contained in the Non-legally Binding Agreement on all Types of Forests. It is also a common indicator in all the ecoregional processes on criteria and indicators of sustainable forest management.

The most commonly quoted statistics from the global forest resources assessments continue to be the global rate of deforestation and the net loss of forest area. However, as was observed in earlier assessments (FAO, 2001 and FAO, 2006b), the significance of forest area as a single indicator of forest development has often been overemphasized, particularly in the public debate, and other aspects of forest resources have featured less prominently. Many other variables must be considered in determining the relevant trends in the extent of forest resources. Growing stock and carbon storage may be considered equally important parameters, as they indicate whether forests are degraded and to what extent they mitigate climate change. Further, the net loss of forest area is not in itself sufficient to describe land-use dynamics that include both the loss of forests due to deforestation and natural disasters, and gains in forest area from planting or natural expansion. On its own, the area of forest does not tell us what kinds of forests we have, how healthy they are, what benefits they might provide or how well they are managed. Hence, the global forest resources assessments have evolved over time and now contain information on a wide variety of aspects related to forests and forestry.

For FRA 2010, information was sought on the current status and changes over time (1990, 2000, 2005 and 2010) of the following six variables related to the extent of forest resources:

- Area of 'forest' and 'other wooded land'. Countries were also encouraged to provide information on 'other land with tree cover'.[3]
- Characteristics of forests according to three classes: primary forests, other naturally regenerated forests and planted forests. For the latter two, countries were also asked to provide data on the area of forest composed of introduced species.

[3] See Annex 2 for definitions.

- Area of selected forest types: mangroves, bamboo and rubber plantations.
- Standing volume of wood, i.e. the total growing stock in forests and other wooded land, and its composition.
- Forest biomass.
- Carbon stock contained in woody biomass, dead wood, litter and forest soils.

In regional and ecoregional criteria and indicator processes, as well as in national reports, more detailed classifications of the forest area are often used, for example, according to forest or vegetation type, age structure or diameter distribution classes. Because of the varying conditions and classification systems among countries and regions, it was not feasible to report on such classifications at the global level except for the three selected forest types listed above. However, country reports for FRA 2010 contain considerably more detail than is shown in the global tables.

In FRA 2000, an independent remote sensing survey was carried out to supplement country reporting for the pantropical region. The results constituted an important ingredient in the analysis of global and regional trends, leading for example, to a calibration of reported changes in forest area for Africa. The survey also provided considerable insight into processes of land-use change, including the documentation of different patterns of change in tropical regions. The results have been widely acknowledged and used (e.g. Mayaux *et al.*, 2005). A more ambitious global remote sensing survey is currently being carried out as part of FRA 2010 (see Box 2.3), which will complement the information in this report in terms of forest area changes over time in large biomes, as well as providing more detailed information on land-use change dynamics at regional and global levels.

KEY FINDINGS

Forests cover 31 percent of total land area

The world's total forest area in 2010 is estimated to be just over 4 billion hectares, corresponding to an average of 0.6 ha of forest per capita. However, the area of forest is unevenly distributed. The five most forest-rich countries (the Russian Federation, Brazil, Canada, the United States of America and China) account for more than half of the total forest area (53 percent), while 64 countries with a combined population of 2 billion people have forest on no more than 10 percent of their land area. These include a number of fairly large countries in arid zones, as well as many small island developing states (SIDS) and dependent territories. Ten of these have no forests at all.

The total area of other wooded land is estimated to be at least 1.1 billion hectares, equivalent to 9 percent of the total land area. The total area of other land with tree cover was reported to be 79 million hectares, but is undoubtedly much higher as information availability was limited.

The rate of deforestation shows signs of decreasing, but is still alarmingly high

Around 13 million hectares of forest were converted to other uses – largely agriculture – or lost through natural causes each year in the last decade. This compares with a revised figure of 16 million hectares per year in the 1990s. Both Brazil and Indonesia, which had the highest net loss of forest in the 1990s, have significantly reduced their rate of loss, while in Australia, severe drought and forest fires have exacerbated the loss of forest since 2000.

Afforestation and natural expansion of forests in some countries have significantly reduced the net loss of forest area at the global level

The net change in forest area in the period 2000–2010 is estimated at -5.2 million hectares per year at the global level (an area about the size of Costa Rica). This is down from -8.3 million hectares per year in the period 1990–2000. This substantial reduction is due to both a decrease in the deforestation rate and an increase in the area of new forest established through planting or seeding and the natural expansion of existing forests.

More than 90 percent of the total forest area consists of naturally regenerated forests

Primary forests – forests of native species in which there are no clearly visible signs of past or present human activity – are estimated to occupy 36 percent of the total forest area. Other naturally regenerated forests make up some 57 percent, while planted forests account for an estimated 7 percent, of the total forest area.

The area of mangroves continues to decline, while the area of bamboo and rubber plantations is increasing

The total area of mangroves is estimated at 15.6 million hectares as of 2010, down from 16.1 million hectares in 1990. Nearly half the total mangrove area (47 percent) is found in five countries: Indonesia, Brazil, Nigeria, Australia and Mexico.

The area of bamboo is difficult to assess, as these species often occur as patches within forests or as clusters outside them. Nevertheless, preliminary findings based on information from 33 of the main bamboo-rich countries indicate that the total area is about 31.5 million hectares.

Rubber plantations are found in relatively few countries – primarily in Southeast Asia and Africa – and cover an estimated 10 million hectares. While the area of rubber increased rapidly in the 1990s, the rate of increase is now beginning to slow down and is currently decreasing in several countries.

In 2010, the estimated total growing stock in the world's forest amounted to about 527 billion m^3

This corresponds to an average of 131 m^3 per hectare. The highest levels of growing stock per hectare were found in central Europe and some tropical areas. There was a small decline in total growing stock over the period 1990–2010, but it is unlikely that this change is significant in statistical terms.

Forests contain more carbon than the entire atmosphere

The world's forests store more than 650 billion tonnes of carbon, 44 percent in the biomass, 11 percent in dead wood and litter, and 45 percent in the soil. While sustainable management, planting and rehabilitation of forests can conserve or increase forest carbon stocks, deforestation, degradation and poor forest management reduce them. For the world as a whole, carbon stocks in forest biomass decreased by an estimated 0.5 Gt annually during the period 2005–2010. This was mainly because of a reduction in the global forest area and occurred despite an increase in growing stock per hectare in some regions.

KEY CONCLUSIONS

Considerable progress has been made towards reversing the overall trend of forest area loss, and several variables related to the extent of forest resources show no significant negative trends or even a positive trend over time in some countries and regions. Yet deforestation, including uncontrolled conversion of forests to agricultural land, continues at an alarmingly high rate in many countries. Considerable efforts are needed to ensure the overall trend in extent of forest resources is positive or stable in all regions.

FOREST AREA AND FOREST AREA CHANGE

Introduction

Forest area provides the first indication of the relative importance of forests in a country or region. Estimates of the change in forest area over time provide an indication of the demand for land for forestry and other uses. Forest area is relatively easy to measure and has been selected as one of 60 indicators for monitoring progress towards the Millennium Development Goals (Goal 7 – Ensuring environmental sustainability), the 2010 Biodiversity Target and the Global Objectives on Forests.

Data on the status of and trends in forest area are crucial to decisions about forest and land-use policies and resource allocations, but they need to be combined with information on other aspects such as forest health and vitality, and socio-economic and environmental functions and values of forests. These aspects are dealt with in other chapters of this report.

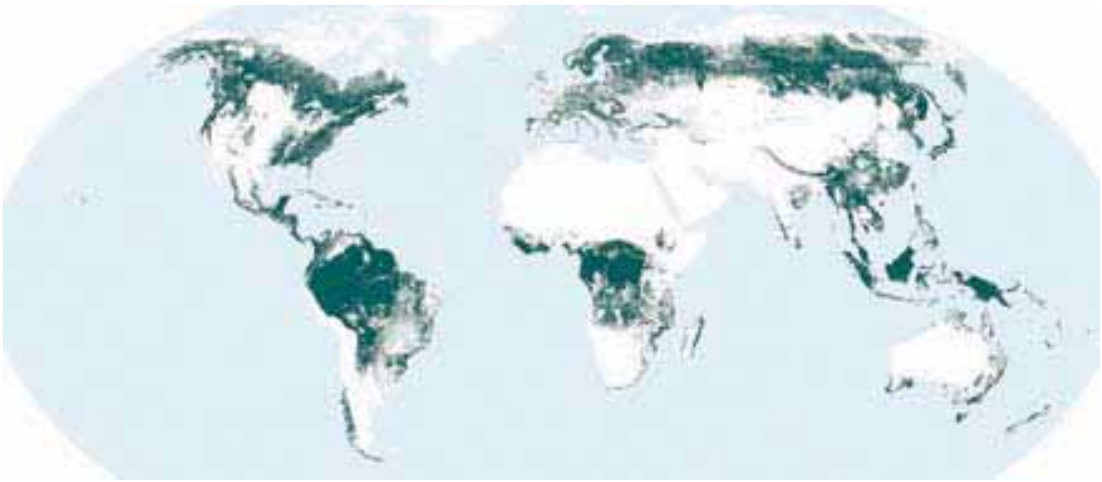
Status

All 233 countries and areas reporting for FRA 2010 provided information on the extent of forests. The total forest area in 2010 was estimated to be 4 billion hectares, or 31 percent of total land area. This corresponds to an average of 0.6 ha per capita. As can be seen from Figure 2.1, the area of forest is unevenly distributed. The five most forest-rich countries (the Russian Federation, Brazil, Canada, the United States of America and China) account for more than half of the total forest area (53 percent), while 64 countries, with a combined population of 2 billion people, have forest on no more than 10 percent of their land area.

The distribution of forests at the subregional level is shown in Table 2.1. Europe (including the Russian Federation) accounts for 25 percent of the world's total forest area, followed by South America (21 percent), and North and Central America (17 percent). Information on the area of forest and other wooded land by country can be found in Table 2 in Annex 3.

At the country level, the Russian Federation alone accounts for 20 percent of the total forest area in the world. Seven countries have more than 100 million hectares of forest each, and the ten most forest-rich countries (the Russian Federation, Brazil, Canada, United States of America, China, Democratic Republic of the Congo, Australia, Indonesia, Sudan and India) account for 67 percent of total forest area (Figure 2.2). The remaining 33 percent is spread among 213 countries and areas, while ten countries

FIGURE 2.1
The world's forests



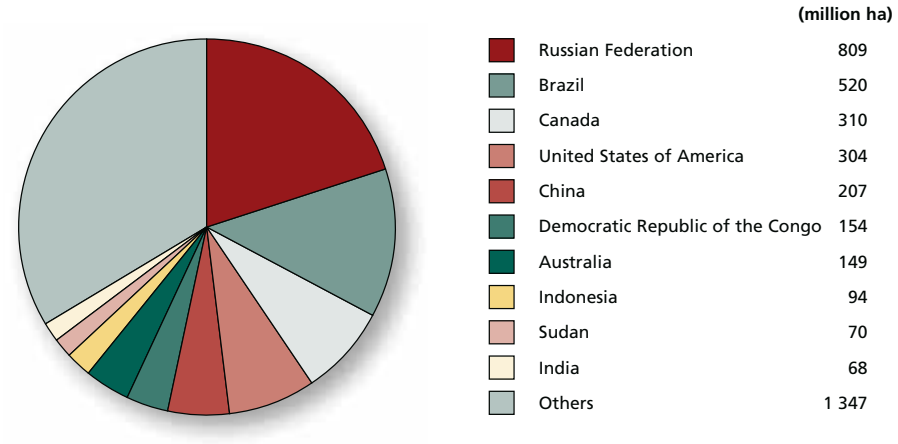
Note: Tree cover derived from MODIS VCF* 250 meter pixels for year 2005.

* Moderate-resolution Imaging Spectroradiometer Vegetation Continous Fields (Hansen *et al*. 2010).

TABLE 2.1
Distribution of forests by region and subregion, 2010

Region/subregion	Forest area	
	1 000 ha	% of total forest area
Eastern and Southern Africa	267 517	7
Northern Africa	78 814	2
Western and Central Africa	328 088	8
Total Africa	**674 419**	**17**
East Asia	254 626	6
South and Southeast Asia	294 373	7
Western and Central Asia	43 513	1
Total Asia	**592 512**	**15**
Russian Federation	809 090	20
Europe excl. Russian Federation	195 911	5
Total Europe	**1 005 001**	**25**
Caribbean	6 933	0
Central America	19 499	0
North America	678 961	17
Total North and Central America	**705 393**	**17**
Total Oceania	**191 384**	**5**
Total South America	**864 351**	**21**
World	**4 033 060**	**100**

FIGURE 2.2
Ten countries with the largest forest area, 2010



and areas (the Falkland Islands (Malvinas*), Gibraltar, the Holy See, Monaco, Nauru, Qatar, Saint Barthélemy, San Marino, Svalbard and Jan Mayen Islands, and Tokelau) reported that they have no areas that qualify as forests using the FRA 2010 definition.

In 50 countries and areas forests cover more than half the total land area (Figure 2.3) and in 12 of these forests occupy more than 75 percent of the total land area. Most of these high forest cover countries are small island states or territories, but the list also includes three low-lying coastal states in South America and one country in the Congo Basin (Table 2.2 shows the top ten). At the regional level, South America has the highest percentage of forest cover, followed by Europe (including the Russian Federation), and North and Central America. Asia has the lowest percentage of forest cover (Table 2.3).

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

FIGURE 2.3
Forest area as a percentage of total land area by country, 2010

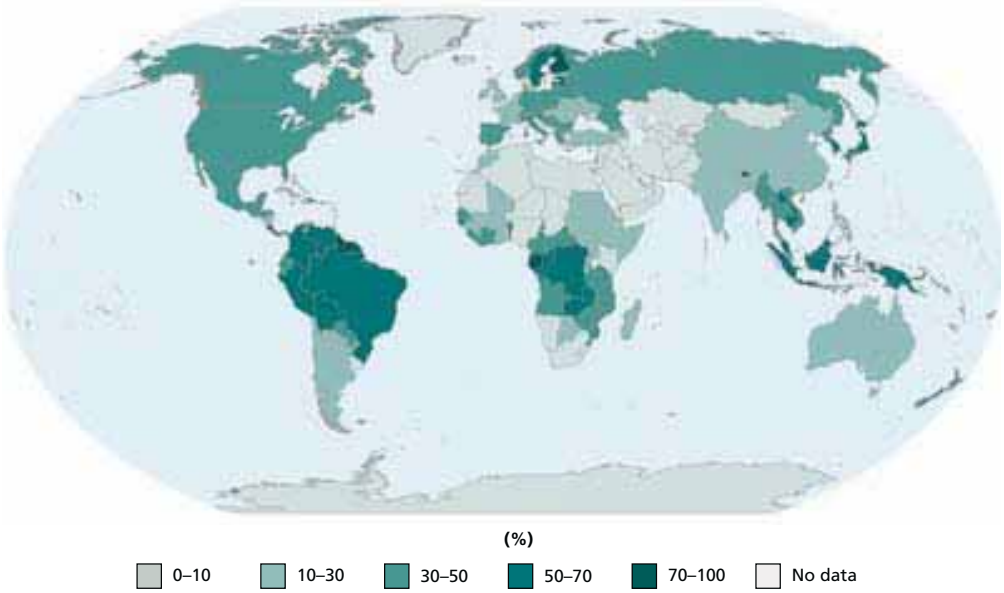


TABLE 2.2
High forest cover countries, 2010

Country/area	Forest area	
	1 000 ha	% of land area
French Guiana	8 082	98
Suriname	14 758	95
Micronesia (Federated States of)	64	92
American Samoa	18	89
Seychelles	41	88
Palau	40	88
Gabon	22 000	85
Pitcairn	4	83
Turks and Caicos Islands	34	80
Solomon Islands	2 213	79

In 64 countries and areas, forests cover no more than 10 percent of the total land area. Often referred to as low forest cover countries (LFCCs), these include many SIDS and dependent territories, as well as 16 larger countries with relatively substantial forest areas (more than 1 million hectares each). Three of these (Chad, the Islamic Republic of Iran and Mongolia) each have more than 10 million hectares of forest.

A total of 161 countries and areas reported that they had some land classified as 'other wooded land' in 2010. However, it was evident from the comments provided in the country reports that the vast majority of the remaining 72 countries and areas also have vegetation that would be categorized as other wooded land using the definitions employed for FRA 2010, but currently have no reliable data on the actual extent.

The total area of other wooded land is estimated to be at least 1.1 billion hectares – equivalent to 9 percent of the total land area. This category suffered from reclassification problems, particularly in dry zones such as those in Australia, Kenya, Mozambique and Sudan, where the distinction between forest and other wooded land is not very clear.

TABLE 2.3
Forest cover by region and subregion, 2010

Region/subregion	Forest area	
	1 000 ha	% of land area
Eastern and Southern Africa	267 517	27
Northern Africa	78 814	8
Western and Central Africa	328 088	32
Total Africa	**674 419**	**23**
East Asia	254 626	22
South and Southeast Asia	294 373	35
Western and Central Asia	43 513	4
Total Asia	**592 512**	**19**
Russian Federation	809 090	49
Europe excl. Russian Federation	195 911	34
Total Europe	**1 005 001**	**45**
Caribbean	6 933	30
Central America	19 499	38
North America	678 961	33
Total North and Central America	**705 393**	**33**
Total Oceania	**191 384**	**23**
Total South America	**864 351**	**49**
World	**4 033 060**	**31**

The ten countries with the largest area of other wooded land (Australia, China, Canada, the Russian Federation, Argentina, Sudan, Ethiopia, Brazil, Botswana and Afghanistan) include six of the ten countries with the largest forest area.

Only 85 countries and areas, together accounting for 38 percent of the global forest area, reported on the current extent of other land with tree cover. This variable aims to capture those areas in which forest cover criteria are met, but the predominant land use is agricultural (e.g. orchards and oil palm plantations) or urban (e.g. parks). The total area of other land with tree cover is at least 79 million hectares. This estimate was limited by a lack of information, and the true extent is undoubtedly much higher.

The category 'other land with tree cover' includes part of the larger category 'trees outside forests'. These trees constitute an important resource in many countries, but one which is difficult to quantify (see Box 2.1).

Trends

All countries and areas provided estimates of forest area for all four reporting years (1990, 2000, 2005 and 2010) with the exception of two dependent territories, Saint Barthélemy and French Polynesia, which did not provide an estimate for 1990. For the purpose of analysis, the 1990 forest area for these two territories was estimated based on a linear extrapolation of the figures provided for 2000 and 2005. However, some countries possessed comprehensive information from only one point in time, while others had a number of estimates over time that were incompatible, making trend analyses difficult.

Deforestation, mainly due to conversion of forests to agricultural land, shows signs of decreasing in several countries but continues at an alarmingly high rate in others. Globally around 13 million hectares of forest were converted to other uses or lost through natural causes each year in the last decade. This compares with a revised figure of 16 million hectares per year in the 1990s. Both Brazil and Indonesia (which had the highest net loss of forest in the 1990s) have significantly reduced their rates of loss, while in Australia, severe drought and forest fires have exacerbated the loss of forest since 2000.

BOX 2.1

Special study on trees outside forests

The latest Expert Consultation on the Global Forest Resources Assessment (Kotka V, June 2006), recommended that a special study on trees outside forests should be carried out as part of FRA 2010. The inception workshop for the study was held in Rome on 9–10 June 2010. During the workshop, 42 experts from 31 institutions in 17 countries defined the objectives, scope and process for developing the study. The report is expected to be prepared by March 2011.

What are trees outside forests?

'Trees outside forests' refers to trees found on lands that are not categorized as 'forest' nor as 'other wooded land'. They include trees (isolated, linear and groups or stands of trees and tree systems) found in rural landscapes (e.g. on farms, in fields, pastures and various forms of horticulture and agroforestry systems, in hedges, along roads and streams) and in urban settings (e.g. on private or public lands and along streets).

Trees have been part of local land use systems for millennia. The products derived from them, such as food, medicine, cooking fuel, animal fodder and construction materials, are critical for the subsistence of hundreds of millions of people. Trees in rural landscapes also have protective functions at farm, landscape and global levels. They maintain soil fertility, allow more efficient water and nutrient resource use, control water erosion, and contribute to microclimate moderation. The ecosystem services they provide at a global level in carbon sequestration and biodiversity conservation are also significant. Trees in human settlements are no less important: in addition to their various products, they provide services, such as microclimate moderation and a 'green' environment conducive to good health.

The challenge: towards integration of trees outside forests in development policies

A recent study (Zomer *et al*., 2009) has shown the importance of trees outside forests at a global scale: almost half of the agricultural land in the world (more than 1 billion hectares) has tree cover of more than 10 percent. However, in most countries trees outside forests are still poorly reported in the official statistics used to support national decision-making and policy. The most basic information – such as location, number, species, spatial organization, biomass, growth and production – is often lacking. Trees outside forests are thus most often ignored in land-use planning and development policies. One major reason for this lack of information is the difficulty and cost of assessing trees outside forests at the national scale.

For this reason the experts gathered during the inception workshop for this study recommended that the report should encourage countries to carry out timely and high quality assessments of trees outside forests at a national level. The report will include:

- a review and comparative analysis of past and current large scale (national and regional) assessments of trees outside forests, including the methodology, results and precision, costs and uses of the assessment (including policy implications);
- a set of methodological and technical options for national-level assessments of trees outside forests, including an operational typology, enabling reporting to international processes such as FRA and IPCC;
- recommendations for improving integration of trees outside forests into the FRA reporting process.

The study is intended to support national agencies responsible for forestry, agriculture, environment, and rural and urban development, by providing adapted tools and methods to assess resources of trees outside forests, as well as their products, uses and economic and environmental functions, at a national level. Through such assessments, local and national decision-makers will be better able to take into account resources of trees outside forests and the services they provide. This support to decision-makers and land-use planners is especially important for developing countries as the contribution of trees outside forests to people's livelihoods and national economies is expected to dramatically increase in the current context of climate change, financial crisis and food insecurity.

At the same time, afforestation and natural expansion of forests in some countries and regions have significantly reduced the net loss of forest area at the global level (see Box 2.2). The total net change in forest area in the period 1990–2000 is estimated at -8.3 million hectares per year, which is equivalent to a loss of 0.20 percent of the remaining forest area each year during this period.

The total net change in forest area in the period 2000–2010 is estimated at -5.2 million hectares per year, an area slightly bigger than the size of Costa Rica, or equivalent to a loss of more than 140 km² of forest per day. The current annual net loss is 37 percent lower than that in the 1990s, and equals a loss of 0.13 percent of the remaining forest area each year during this period. This substantial reduction in the rate of forest loss is a result of both a decrease in the deforestation rate and an increase in the area of new forest established through planting or seeding and natural expansion of existing forests.

The changes in area of forest by region and subregion are shown in Table 2.4 and Figure 2.5. At a regional level, South America suffered the largest net loss of forests between 2000 and 2010 – about 4.0 million hectares per year – followed by Africa, which lost 3.4 million hectares annually.

In South America the net loss of forest decreased in recent years after a peak in the period 2000–2005. The average annual net loss of forest was 4.2 million hectares in the 1990s, 4.4 million hectares in the period 2000–2005, and has now dropped to an estimated 3.6 million hectares per year in the period 2005–2010. The regional figures primarily reflect the trends in Brazil, which accounts for 60 percent of the forest area in this region.

BOX 2.2

Deforestation and net change in forest area

Figure 2.4 is a simplified model illustrating forest change dynamics. It has only two classes: forests and all other land. A reduction in forest area can happen through either of two processes: deforestation and natural disasters. Deforestation, which is by far the most important, implies that forests are cleared by people and the land converted to another use, such as agriculture or infrastructure. Natural disasters may also destroy forests, and when the area is incapable of regenerating naturally and no efforts are made to replant, it too converts to other land.

An increase in forest area can also happen in two ways: either through afforestation (i.e. planting or seeding of trees on land that was not previously forested), or through natural expansion of forests (e.g. on abandoned agricultural land, a process which is quite common in some European countries).

Where part of a forest is cut down but replanted (reforestation) or grows back on its own within a relatively short period (natural regeneration) there is no change in forest area.

For FRA 2010, countries were asked to provide information on their forest area for four points in time. This permits the calculation of the net change in forest area over time. This net change is the sum of all negative changes due to deforestation and natural disasters and all positive changes due to afforestation and natural expansion of forests.

FIGURE 2.4

Forest change dynamics

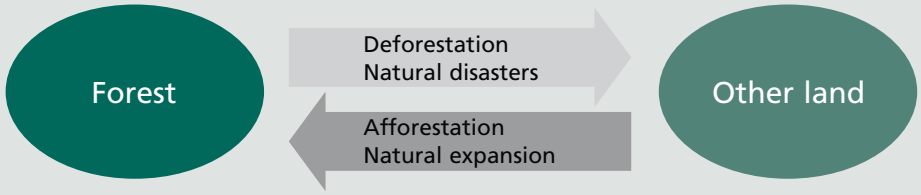
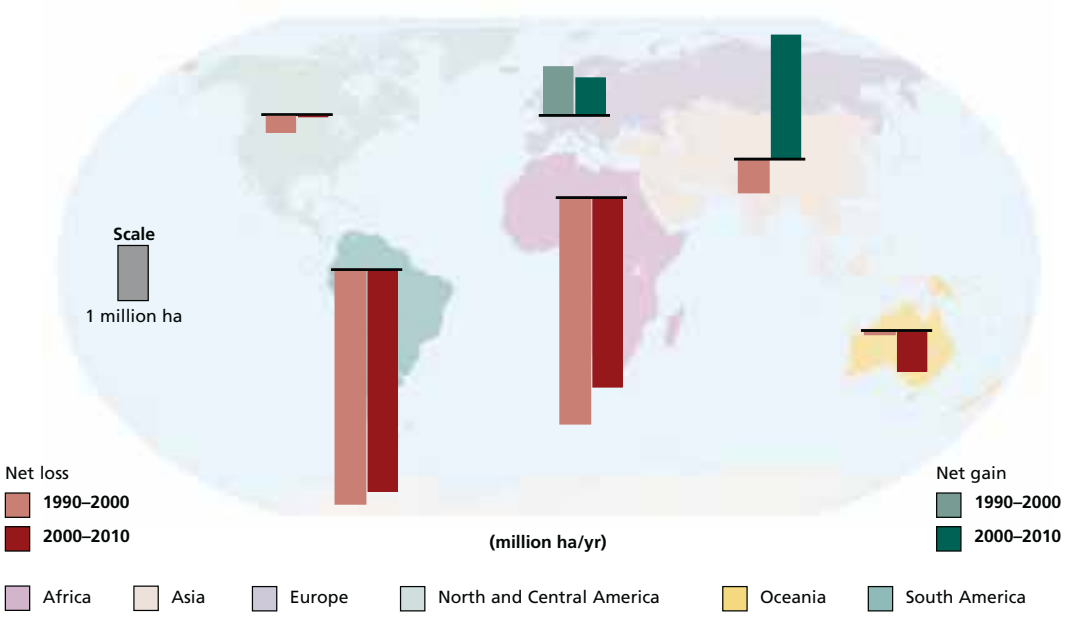


TABLE 2.4
Annual change in forest area by region and subregion, 1990–2010

Region/subregion	1990–2000		2000–2010	
	1 000 ha/yr	%	1 000 ha/yr	%
Eastern and Southern Africa	-1 841	-0.62	-1 839	-0.66
Northern Africa	-590	-0.72	-41	-0.05
Western and Central Africa	-1 637	-0.46	-1 535	-0.46
Total Africa	**-4 067**	**-0.56**	**-3 414**	**-0.49**
East Asia	1 762	0.81	2 781	1.16
South and Southeast Asia	-2 428	-0.77	-677	-0.23
Western and Central Asia	72	0.17	1 31	0.31
Total Asia	**-595**	**-0.10**	**2 235**	**0.39**
Russian Federation	32	n.s.	-18	n.s.
Europe excl. Russian Federation	845	0.46	694	0.36
Total Europe	**877**	**0.09**	**676**	**0.07**
Caribbean	53	0.87	50	0.75
Central America	-374	-1.56	-248	-1.19
North America	32	n.s.	188	0.03
North and Central America	**-289**	**-0.04**	**-10**	**-0.00**
Total Oceania	**-41**	**-0.02**	**-700**	**-0.36**
Total South America	**-4 213**	**-0.45**	**-3 997**	**-0.45**
World	**-8 327**	**-0.20**	**-5 211**	**-0.13**

FIGURE 2.5
Annual change in forest area by region, 1990–2010



While there are signs that the net loss of forests in Africa is decreasing (from 4.1 million hectares per year in the 1990s to 3.4 million hectares per year in the last decade), few countries have reliable data from comparable assessments over time, so the resulting trends should be treated with caution. One of the main reasons for the decreasing net loss overall is a sharp reduction in the net loss reported by Sudan, where

recent efforts to gather new data on actual changes taking place on an annual basis have resulted in much lower figures than those estimated for 1990–2000, which were based on fairly old data. As a result the forest area of Northern Africa is now estimated to be relatively stable, while it is still decreasing in the rest of the continent.

Asia, which saw a net loss of some 0.6 million hectares per year in the 1990s, reported an average net gain of more than 2.2 million hectares per year between 2000 and 2010. This was primarily a result of large-scale afforestation reported by China (where the forest area increased by 2 million hectares per year in the 1990s and by an average of 3 million hectares per year since 2000), but was also due to a reduction in the rate of deforestation in some countries, including Indonesia.

In South and Southeast Asia deforestation continues, but the net loss of 2.4 million hectares per year reported for the 1990s is now down to an estimated 0.7 million hectares annually. Indonesia reported a very significant drop in its rate of net loss in the 2000–2005 period compared with the 1990s and, although the rate increased again in the last five years, it is still less than half that seen during and shortly after the peak of the large-scale transmigration programme in the 1980s and early 1990s. This drop is consistent with other recent findings based on the use of remote sensing (Hansen *et al*., 2009). However, many other countries in South and Southeast Asia continue to report high rates of net loss of forest area. Forest area continues to grow rapidly in East Asia due to the afforestation efforts in China, while in Western and Central Asia the forest area is expanding slightly.

In Europe the forest area expanded over the period 2000 to 2010 by just under 0.7 million hectares per year, in comparison with slightly less than 0.9 million hectares per year in the 1990s. The slightly fluctuating trend seen in the Russian Federation is insignificant in statistical terms given the large forest area, while an apparent increase in forest area in Sweden between 2000 and 2005 is due to a change in assessment methodology.

In North and Central America as a whole, the forest area was estimated to be almost the same in 2010 as in 2000. While the forest area continues to decrease in all countries in Central America except Costa Rica, it is increasing in North America, where the net loss in Mexico is outweighed by a net gain in the United States of America. The Caribbean reports a gain in forest area due to afforestation in Cuba and because forests are expanding onto abandoned agricultural land in some islands.

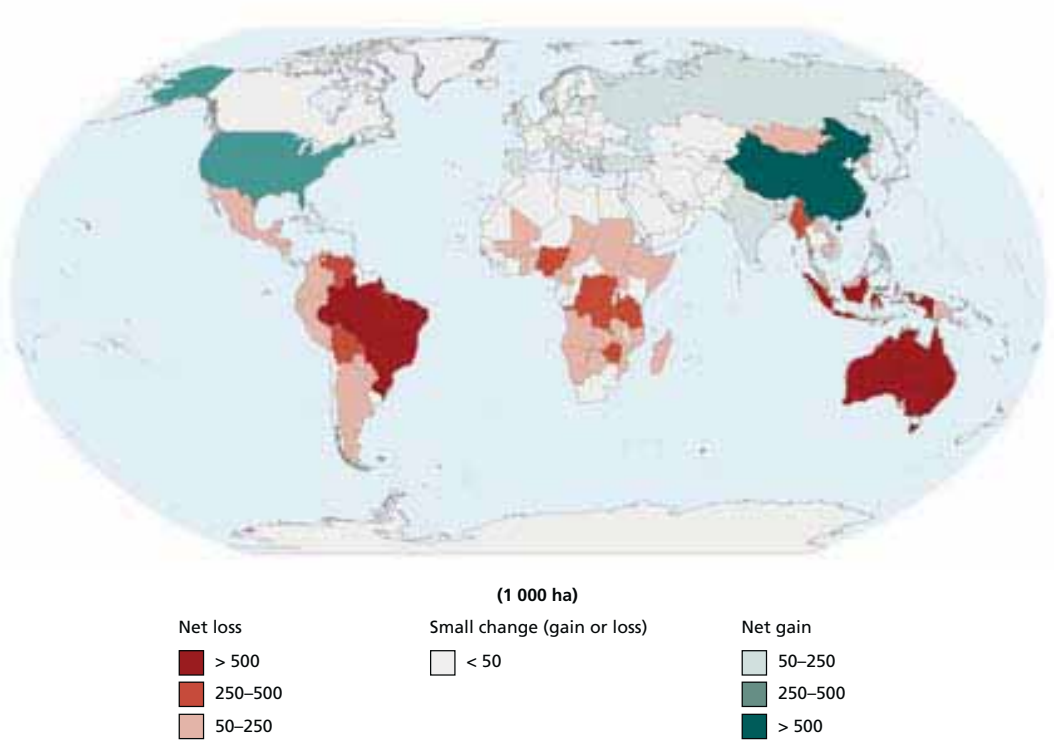
Oceania reported a net loss of about 0.7 million hectares per year over the period 2000–2010. The net loss seems to be increasing and is reported to be more than 1 million hectares per year in the last five years. This is due to large losses of forests in Australia, where severe drought and forest fires have exacerbated the loss of forest since 2000. However, as mentioned in the Country Report from Australia: "It is understood the most likely reason for the detected decline in forest extent is the extended drought across much of Australia since 2000 which has resulted in a double loss: a decline in forest regrowth along with a decline in tree foliage from water stress (the reduced foliage is detected by satellites as a loss of forest extent). It is unclear at this stage whether the climatic-induced reduction is a temporary or permanent loss of forest."[4]

For information on changes in forest area by country, see Table 3 in Annex 3 and Figure 2.6.

In the Caribbean, Europe, North America and Oceania the majority of countries show no significant changes in forest area over the last five years (using +/-0.5 percent annually as the threshold), while in Africa and Central America the majority of countries report a significant negative change rate. However, a large number of

[4] While a temporary loss of forest cover should not count as a loss of forest area using the definitions employed by the FRA process, the assessment method used in Australia did not allow for a differentiation between temporary and permanent loss of forest. As a result, the net loss of forest area reported to FRA 2010 may be overestimated.

FIGURE 2.6
Annual change in forest area by country, 2005–2010



countries in Oceania and the Caribbean reported no change in forest area simply because of a lack of data for more than one point in time.

The ten countries with the largest net loss per year in the period 1990–2000 had a combined net loss of forest area of 7.9 million hectares per year. In the period 2000–2010, this was reduced to 6.0 million hectares per year as a result of reductions in Indonesia, Sudan and Brazil and despite increased net losses in Australia (see Table 2.5).

The ten countries with the largest net gain per year in the period 1990–2000 had a combined net gain of forest area of 3.4 million hectares per year due to afforestation efforts and natural expansion of forests. In the period 2000–2010, this increased to 4.4 million hectares per year due to the implementation of ambitious afforestation programmes in China (Table 2.6).

Twenty-eight countries and areas have an estimated net loss of 1 percent or more of their forest area per year. The five countries with the largest annual net loss for 2000–2010 are: Comoros (-9.3 percent); Togo (-5.1 percent); Nigeria (-3.7 percent); Mauritania (-2.7 percent) and Uganda (-2.6 percent). Nineteen countries have an estimated annual net gain of 1 percent or more due to afforestation and natural expansion of forests. The five countries with the largest estimated annual positive change rates for 2000–2010 are: Iceland (5.0 percent); French Polynesia (4.0 percent); Kuwait (2.6 percent); Rwanda (2.4 percent) and Uruguay (2.1 percent). Most, but not all, of the countries with large change rates measured in percentages are low forest cover countries, in which a relatively small change in absolute values results in a large change in relative or percentage terms.

At the global level, the area of other wooded land decreased by about 3.1 million hectares per year during the decade 1990 to 2000 and by about 1.9 million hectares per

TABLE 2.5
Ten countries with largest annual net loss of forest area, 1990–2010

Country	Annual change 1990–2000		Country	Annual change 2000–2010	
	1 000 ha/yr	%		1 000 ha/yr	%
Brazil	-2 890	-0.51	Brazil	-2 642	-0.49
Indonesia	-1 914	-1.75	Australia	-562	-0.37
Sudan	-589	-0.80	Indonesia	-498	-0.51
Myanmar	-435	-1.17	Nigeria	-410	-3.67
Nigeria	-410	-2.68	United Republic of Tanzania	-403	-1.13
United Republic of Tanzania	-403	-1.02	Zimbabwe	-327	-1.88
Mexico	-354	-0.52	Democratic Republic of the Congo	-311	-0.20
Zimbabwe	-327	-1.58	Myanmar	-310	-0.93
Democratic Republic of the Congo	-311	-0.20	Bolivia (Plurinational State of)	-290	-0.49
Argentina	-293	-0.88	Venezuela (Bolivarian Republic of)	-288	-0.60
Total	**-7 926**	**-0.71**	**Total**	**-6 040**	**-0.53**

TABLE 2.6
Ten countries with largest annual net gain in forest area, 1990–2010

Country	Annual change 1990–2000		Country	Annual change 2000–2010	
	1 000 ha/yr	%		1 000 ha/yr	%
China	1 986	1.20	China	2 986	1.57
United States of America	386	0.13	United States of America	383	0.13
Spain	317	2.09	India	304	0.46
Viet Nam	236	2.28	Viet Nam	207	1.64
India	145	0.22	Turkey	119	1.11
France	82	0.55	Spain	119	0.68
Italy	78	0.98	Sweden	81	0.29
Chile	57	0.37	Italy	78	0.90
Finland	57	0.26	Norway	76	0.79
Philippines	55	0.80	France	60	0.38
Total	**3 399**	**0.55**	**Total**	**4 414**	**0.67**

year in the last decade (2000–2010). This finding should be treated with caution, however, because many countries still do not have compatible information over time for other wooded land, and thus one estimate was frequently used as the best available figure for all four reporting years. The data reported for FRA 2010 indicate that the area of other wooded land is more or less constant in North and Central America, and Oceania. However, the latter is constrained by a lack of consistent trend data for Australia. In Europe it decreased in the period 1990–2000, but remained almost constant in the period 2000–2010. The area of other wooded land decreased in both periods in Africa, Asia and South America.

Data for other land with tree cover were very sparse. Based on the information provided by the 74 countries that provided data for all four reporting years, the area of other land with tree cover has been expanding by an average of slightly more than half a million hectares annually in the last 20 years.

Comparison with FRA 2005

The global forest area reported for FRA 2010 is larger than that reported for FRA 2005 for all reporting years (see Table 2.7). The difference is approximately 109 million hectares

(or 2.8 percent) for the estimates for 2005. This is mainly because Brazil reported an additional 53 million hectares of forest as a result of the use of higher resolution remote sensing imagery and both the Democratic Republic of the Congo and Mozambique reported more than 20 million hectares of additional forest – some of which was no doubt due to a reclassification of land earlier reported as other wooded land (see below). Indonesia reported an additional 9 million hectares for 2005 because the earlier estimate was forecasted based on data from 2000 and the annual deforestation rate for the 1990s, while the new estimate utilized updated figures from 2003 and 2006, which show that the deforestation rate had declined considerably, especially in the period 2000–2005. Australia, on the other hand, reported 9 million hectares less for 2005 than reported in the last global assessment. Again, this is due to new information on the actual forest area (from 2008) and revised annual change rates.

As in FRA 2005, data on deforestation rates were not directly compiled for FRA 2010 because few countries have this information. In FRA 2005 the global deforestation rate was estimated from net changes in forest area. Additional information on afforestation and natural expansion of forest for the past 20 years collected for FRA 2010 has now also made it possible to take into account deforestation and loss from natural causes within those countries that have had an overall net gain in forest area – including four of the five countries with the largest forest area in the world. As a result, the revised estimate of the global rate of deforestation and loss from natural causes for 1990–2000 (close to 16 million hectares per year) is higher, but more accurate, than was estimated in FRA 2005 (13 million hectares). While the deforestation rate for the tropical countries for the 1990s did not change significantly as a result of this additional information, the inclusion of countries in the temperate and boreal zone made a significant difference.

For FRA 2010, the global area of other wooded land in 2005 is 216 million hectares lower than that reported for the same year for FRA 2005, despite the fact that figures are now available for Afghanistan, Brazil, Indonesia and the United States of America, adding some 113 million hectares (for 2005). The reason is a substantial downward revision of the estimates of other wooded land in Australia (down 286 million hectares when comparing the new 2010 figure with the old 2005 figure), Democratic Republic of the Congo (down 72 million hectares), Saudi Arabia (down 33 million hectares), Mozambique (down 26 million hectares), Kenya and Mali (both down 6 million hectares). This is only partially outweighed by the area in the additional countries and upward revisions in China (up 17 million hectares), Myanmar and the United Republic of Tanzania (both up 9 million hectares), the Philippines and Colombia (both up 5 million hectares).

TABLE 2.7
Comparison of forest area estimates in FRA 2010 and FRA 2005

Region	Forest area (1 000 ha)								
	FRA 2010			FRA 2005			Differences FRA 2010–FRA 2005		
	1990	2000	2005	1990	2000	2005	1990	2000	2005
Africa	749 238	708 564	691 468	699 361	655 613	635 412	49 877	52 951	56 056
Asia	576 110	570 164	584 048	574 487	566 562	571 577	1 623	3 602	12 471
Europe	989 471	998 239	1 001 150	989 320	998 091	1 001 394	151	148	-244
North and Central America	708 383	705 497	705 296	710 790	707 514	705 849	-2 407	-2 017	-553
Oceania	198 743	198 381	196 745	212 514	208 034	206 254	-13 771	-9 653	-9 509
South America	946 454	904 322	882 258	890 818	852 796	831 540	55 636	51 526	50 718
World	**4 168 398**	**4 085 168**	**4 060 964**	**4 077 291**	**3 988 610**	**3 952 025**	**91 107**	**96 558**	**108 939**

Conclusions

Considerable progress has been made towards reversing the overall trend of forest area loss in recent years. However, most of the net loss of forest still happens in countries in the tropical region while most of the net gain takes place in the temperate and boreal zone and in some emerging economies such as India and Viet Nam.

Forest area is an easily understood baseline variable, which provides a first indication of the relative importance of forests in a country or region. Estimates of change in forest area over time provide an indication of the demand for land for forestry and other land uses. However, the significance of forest area as a single indicator of forest development has often been overemphasized, particularly in the public debate. On its own, the area of forest does not tell us what kinds of forests we have, how healthy they are or what benefits they might provide. Further, the net loss of forest area is not in itself sufficient to describe land-use dynamics that include both loss of forests due to deforestation and natural disasters, and gains in forest area from planting or natural expansion.

Information on the different components of net change in forest area is still weak in many countries. To obtain additional and more consistent information on deforestation, afforestation and natural expansion of forests, at regional and biome levels for the period 1990–2005, FAO is collaborating with countries and key partner organizations to undertake a global remote sensing survey based on a systematic sampling of some 13 500 sites around the globe. Results are expected at the end of 2011 (see Box 2.3).

FOREST CHARACTERISTICS

Introduction

For FRA 2010 countries were asked to provide information on forest characteristics, in order to determine the kinds of forest that exist in terms of their 'naturalness'. There is a continuum from primary forests with no – or no visible – indications of past or present human activity to intensively managed planted forests of introduced species, primarily managed for a single product, often on a relatively short rotation, and frequently consisting of only one species – in some cases a single clone. Between these two extremes lies a wide range of forests, and there are no clear cut-off points between classes along the continuum.

In an attempt to describe this range, countries were asked to characterize their forests according to three classes for FRA 2010: primary forests, other naturally regenerated forests and planted forests, and to include information on the proportion of the forest area composed primarily of introduced species.

This section provides an overview of the status and trends related to these forest characteristics. More detailed information on primary forests can be found in Chapter 3 (Biological Diversity), while further analysis of planted forests is provided in Chapter 5 (Productive Functions of Forests).

Status

Of the 233 countries and areas reporting for FRA 2010, 200 reported on the characteristics of their forests. Their combined forest area was estimated at 3.8 billion hectares – equivalent to 94 percent of the total forest area of the world. Although a large number of countries reported on the characteristics of their forests, many countries either did not collect information directly or used a different national classification system. Proxy values have often been used, which makes a detailed analysis of status and trends difficult. Several countries had, for example, no information on the area of primary forests, so they used the current area of forests in national parks and other protected areas as a proxy value or provided an expert estimate of the percentage of natural forests that could be considered primary according to the definition used for FRA 2010. Thus it may not be possible to directly compare figures for different countries, because of differences in interpretation of the classification systems.

BOX 2.3

The global forest remote sensing survey – better global data on changes in forest extent

Why FAO is carrying out a remote sensing survey of the world's forests

FAO has led remote sensing studies focused on tropical forests for previous FRA reports for 1980, 1990 and 2000. This new study, carried out as part of FRA 2010, will be more comprehensive with satellite images collected globally and aims to substantially improve our knowledge of changes in tree cover and forest land use over time. The increasing importance of climate change is also driving the push for better information because forest and related land use changes are estimated to be responsible for approximately 17 percent of human induced carbon emissions (IPCC, 2007). Satellite data enable consistent information to be collected globally, which can be analysed in the same way for different points in time to derive better estimates of change. Remote sensing does not replace the need for good field data, but combining both provides better results than either method alone.

The key outcomes of the FRA 2010 Remote Sensing Survey will be:

- improved knowledge on land cover and land use changes related to forests, especially deforestation, afforestation and natural expansion of forests;
- information on the rate of change between 1990 and 2005 at global, biome and regional levels;
- a global framework and method for monitoring forest change;
- easy access to satellite imagery through an internet-based data portal;
- enhanced capacity in many countries for monitoring, assessing and reporting on forest area and forest area change.

A scientific sampling design

The survey uses a sampling grid design with imagery taken at each longitude and latitude intersection (approximately 100 kilometres apart), reduced to two degree spacing above 60 degrees North. See Figure 2.7. There are about 13 500 samples, of which about 9 000 are outside deserts and permanent ice (Antarctica is excluded). Each sample site is 10 km by 10 km, giving a total sampling area equivalent to about 1 percent of the Earth's land surface. This grid is compatible with that used for many national forest assessments including those supported by FAO.

FIGURE 2.7
The systematic sampling grid

Easy access to tools and satellite images

FAO and its partner organizations have made pre-processed imagery for the 13 689 sample areas easily available through the internet. (http://www.fao.org/forestry/fra/remotesensing/portal).

Access to free remote sensing data and specialized software will particularly benefit developing countries with limited forest monitoring data or capacity. Authorized national experts can log in and download draft labelled polygons for checking and then upload the validated data.

Improved globally consistent estimates of forest extent and change over time

For each sample, three Landsat images – from around 1990, 2000 and 2005 – have been extracted by the South Dakota State University and further processed by FAO or the European Commission Joint Research Centre (JRC) to a consistent standard using an automated image classification process. Draft land cover labels are then prepared and the changes in land cover over time are highlighted. National experts validate the preliminary results and then help undertake the transformation from land cover classes to land use classes (Figure 2.8).

Strong technical partnerships and engagement with countries

The project combines the technical forest and land cover experience in FAO in partnership with external agencies with funding support from the European Commission and technical expertise from their Joint Research Centre. The results from this work will be reviewed and validated by national experts in about 150 countries. This input makes the results some of the most detailed and widely checked global statistics on forest cover change from satellite data.

South Dakota State University has produced new global tree cover maps using medium resolution (250m) data which are major improvements on the previous 1 km map from FRA 2000. Scientists at Friedrich-Schiller University are testing radar data to 'see' through clouds and develop techniques to overcome some gaps in optical satellite data.

The results of the survey are planned for release in late 2011. Further information is available at: www.fao.org/forestry/fra/remotesensingsurvey/en.

FIGURE 2.8
Example of steps used in processing Landsat data to classified land cover map and resulting land cover change, 1990–2000

Information was also unavailable for some of the larger countries in the Congo Basin, the second largest expanse of tropical forest, and this should be kept in mind when analysing the findings.

More than one-third (36 percent) of the total forest area was classified as primary forest, i.e. forest of native species, in which there are no clearly visible indications of human activity and ecological processes are not significantly disturbed. More than half of all forests (57 percent) are naturally regenerated and show clearly visible indications of human activity. Seven percent were classified as forest established through planting or seeding (see Figure 2.9).

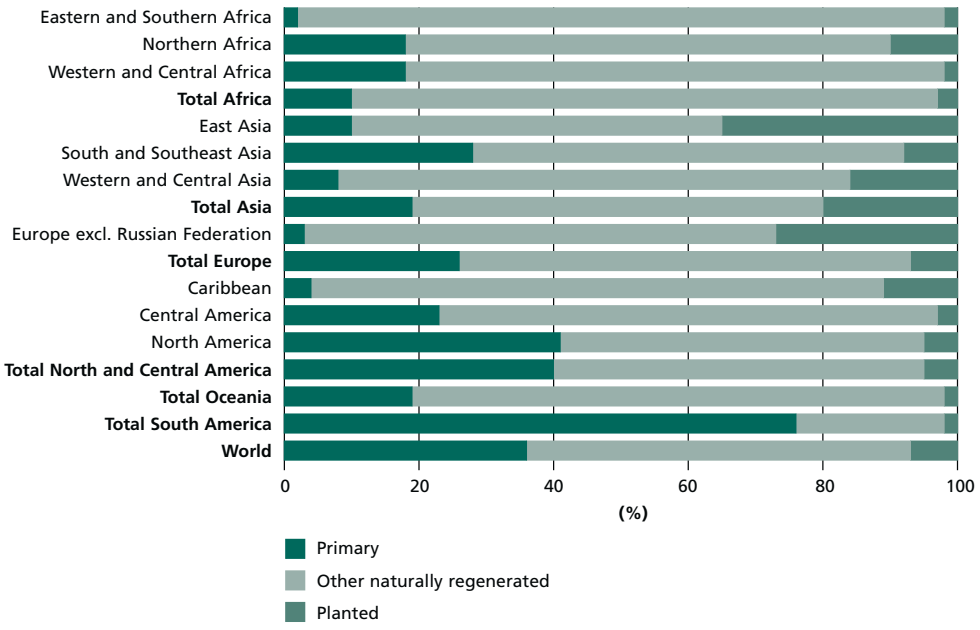
There is great variation in the distribution of primary forests, with limited areas reported from some of the countries of the Caribbean, Europe (excluding the Russian Federation) and the arid zones of Eastern and Southern Africa, Northern Africa, and Western and Central Asia. The largest expanse of primary forest is found in South America (the Amazon). Countries in Central Africa, North and Central America and the Russian Federation have also classified a relatively high proportion of their forests as primary (Table 7 in Annex 3).

East Asia, Europe and North America reported the greatest area of planted forests, together accounting for about 75 percent of the global planted forest area. In East Asia planted forests make up 35 percent of the total forest area, and most are found in China. Africa, the Caribbean, Central America and Oceania all reported relatively small areas of planted forests (Table 5.3).

A total of 83 countries (accounting for 45 percent of the total forest area) reported on the proportion of other naturally regenerated forests composed of introduced species, while 117 countries (67 percent of total forest area) reported on the proportion of introduced species in planted forests.

These countries reported a total area of close to 9 million hectares of naturally regenerated forests composed primarily of introduced species (i.e. naturalized tree

FIGURE 2.9
Forest characteristics by region and subregion, 2010



species) and 52 million hectares of planted forests consisting of introduced species. Together, these introduced species account for about 1.5 percent of the global forest area. Information was too limited to report on trends in introduced species in other naturally regenerated forests. A more detailed analysis of the use of introduced species in planted forests can be found in Chapter 5.

Trends

The trend analysis was based on data from the 183 countries[5] that provided estimates for all four reporting years. Together they account for only 67 percent of the global forest area, so the figures should be treated with caution.

As can be seen in Figure 2.10, the areas of primary forest and other naturally regenerated forests are decreasing, while the area of planted forests is increasing. The area of primary forest has decreased by more than 40 million hectares since 2000. This decrease, 0.4 percent per annum over a ten-year period is largely due to reclassification of primary forest to 'other naturally regenerated forest' because of selective logging and other human interventions during this period.

South America accounted for the largest proportion of the loss of primary forest, followed by Africa and Asia. Brazil alone accounted for an annual loss of primary forest of 2.5 million hectares. The data collected do not permit an analysis of exactly how much of this loss is due to deforestation and how much is a result of areas of forest being moved into the class of other naturally regenerated forests.

The rate of loss of primary forest is stable or decreasing in all regions except Oceania, where it is increasing (primarily as a result of a higher reported loss from Papua New Guinea for the period 2005–2010); and in Europe, and North and Central America which registered a net gain (Refer to Chapter 3 for details).

Between 2000 and 2010, the global area of planted forest increased by about 5 million hectares per year. Most of this was established through afforestation, i.e. planting of areas not forested in recent times, particularly in China.

Conclusions

People have modified the characteristics and species composition of forests for thousands of years to suit their needs. As a result, close to two-thirds of the world's forests show clear signs of past interventions of humans.

While 36 percent of forests are classified as primary, the area is decreasing by some 4 million hectares annually. However, some countries are setting aside parts of their natural forests in which no intervention should take place. With time, these areas evolve into forests that meet the definition of primary as used in the FRA process.

The area of planted forests is increasing and is likely to meet a larger proportion of the demand for wood in the future, thus alleviating the pressure on primary and other naturally regenerated forests.

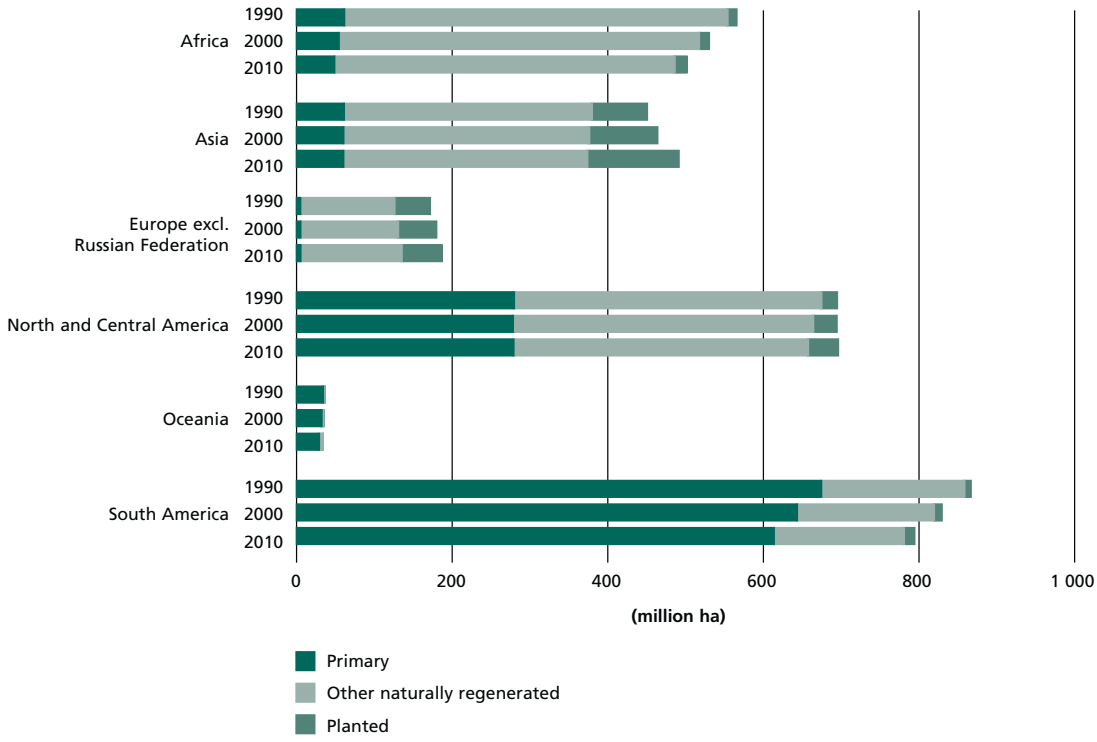
SELECTED FOREST TYPES AND SPECIES GROUPS

Introduction

Countries frequently classify their forest area according to forest or vegetation type, age structure or diameter distribution classes. Because of the varying conditions and classification systems among countries and regions, it was not feasible to report on such classifications at the global level. However, countries were asked to report separately on the areas of mangroves, bamboo and rubber plantations for FRA 2010 as these species groups are well defined and frequently used in countries where they exist. This allows for an analysis of trends in forest area excluding bamboo and rubber

[5] Excluding the Russian Federation where an irregular trend in primary forest is the result of a change in the classification system introduced in 1995.

FIGURE 2.10
Trends in forest characteristics by region and subregion, 1990–2010



plantations, which are not defined as forest in all countries, but are included as forests in the FRA process.

Mangroves

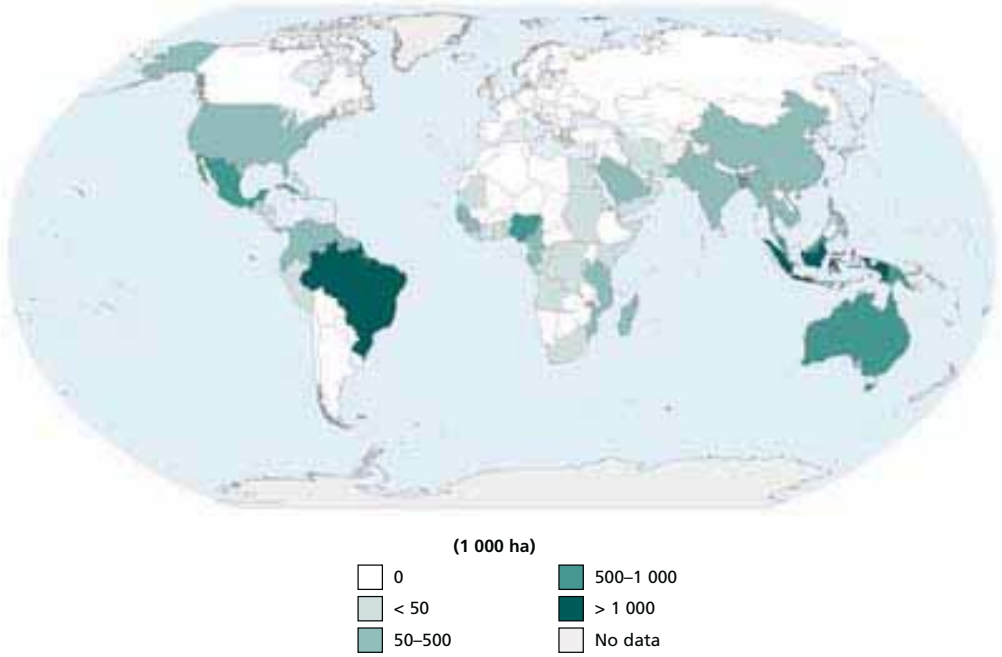
Mangroves are commonly found along sheltered coastlines in the tropics and subtropics where they fulfil important socio-economic and environmental functions. These include the provision of a large variety of wood and NWFPs; coastal protection against the effects of wind, waves and water currents; conservation of biological diversity; protection of coral reefs, seagrass beds and shipping lanes against siltation; and provision of spawning grounds and nutrients for a variety of fish and shellfish, including many commercial species. High population pressure in coastal areas has, however, led to the conversion of many mangrove areas to other uses including infrastructure, aquaculture, rice and salt production (FAO, 2007e).

Status

A total of 212 countries reported on this variable, of which 100 countries reported that they had no mangroves and 112 reported that they had some areas classified as mangroves[6] (see Figure 2.11). This is fewer than the 124 countries and areas with mangroves included in the FRA 2005 Thematic Study on Mangroves (FAO, 2007e), but apart from the Dominican Republic the missing countries and areas all have less than 1 000 ha of mangroves each.

[6] Brazil only reported an estimate for 2000 and Palau only for 1990. Due to a lack of other information, these figures have been used for all four reporting years in this analysis.

FIGURE 2.11
Area of mangroves by country, 2010



Together, the 112 countries and areas reported a total area of mangroves of 15.6 million hectares. The five countries with the largest areas of mangroves (Indonesia, Brazil, Nigeria, Australia and Mexico) together account for some 47 percent of the world total.

Together with the International Society for Mangrove Ecosystems, ITTO, UNEP-WCMC, UNESCO – Man and Biosphere, the United Nations University – Institute for Water Environment and Health and The Nature Conservancy, FAO has recently published a World Atlas of Mangroves containing detailed maps and descriptions of the mangroves in all countries and areas where they are known to exist, see www.fao.org/forestry/mangroves/atlas for details.

Trends

Information for 1990 was missing for eight countries (Australia, China, Cuba, Guadeloupe, the Philippines, Puerto Rico, Saint Kitts and Nevis, and Sudan), and two countries (Nicaragua and the Democratic Republic of the Congo) did not present information for 1990 and 2000. For these countries, the 2000 and 2005 figures respectively were used for this analysis. Given the overall negative trend in mangrove area, this is likely to overestimate the area of mangroves in 1990 and underestimate the loss over time.

The results indicate that the global area of mangroves has decreased from around 16.1 million hectares in 1990 to 15.6 million hectares in 2010[7] (Table 2.8). However, there are indications that there may have been a change in assessment methodologies over time in some countries, which means that the estimates from different years are not completely compatible. Indonesia, for instance, reported a significant increase in

[7] In comparison, FAO (2007e) contained information from 124 countries and areas and estimated the total mangrove area to be 16.9, 15.7 and 15.2 million hectares respectively in 1990, 2000 and 2005.

TABLE 2.8
Trends in area of mangroves by region and subregion, 1990–2010

Region/subregion	Area of mangroves (1 000 ha)			
	1990	2000	2005	2010
Eastern and Southern Africa	991	923	892	861
Northern Africa	4	4	3	3
Western and Central Africa	2 419	2 252	2 207	2 163
Total Africa	**3 414**	**3 178**	**3 102**	**3 027**
East Asia	83	83	83	83
South and Southeast Asia	5 926	6 361	6 200	6 022
Western and Central Asia	187	183	183	183
Total Asia	**6 196**	**6 627**	**6 466**	**6 288**
Total Europe	**0**	**0**	**0**	**0**
Caribbean	763	762	808	857
Central America	481	454	448	443
North America	1 172	1 094	1 086	1 086
Total North and Central America	**2 416**	**2 310**	**2 342**	**2 387**
Total Oceania	**1 860**	**1 841**	**1 537**	**1 759**
Total South America	**2 225**	**2 187**	**2 175**	**2 161**
World	**16 110**	**16 143**	**15 621**	**15 622**

the area of mangroves between 1990 and 2000. Australia reported a similar increase during the period 2005 to 2010 after an even bigger decrease from 2000 to 2005. The reported figures therefore warrant further analysis and the results above should be treated with caution.

The five countries with the largest net loss of mangrove area during the period 2000–2010 were Indonesia, Australia, Myanmar, Madagascar and Mozambique.

Bamboo

Bamboo is a major NWFP and wood substitute. It is found in all regions of the world, both as a component of natural forests and, increasingly, in plantations. Used for housing, crafts, pulp, paper, panels, boards, veneer, flooring, roofing, fabrics, oil, gas and charcoal, it also provides a healthy vegetable (the bamboo shoot). Bamboo industries are now thriving in Asia and are quickly spreading across the continents to Africa and America (FAO, 2007f).

Status

While 131 countries and areas, representing 60 percent of the world's forests, responded to this question, 110 of them reported that they had no bamboo. Only 21 countries reported that they had bamboo resources[8]. This list includes eight countries and areas (Cuba, El Salvador, Jamaica, Martinique, Mauritius, Senegal, Sudan, and Trinidad and Tobago) that were not included in the FRA 2005 Thematic Study on Bamboo (FAO, 2007f). Conversely, 11 countries that were included in the FRA 2005 Study did not report on bamboo for FRA 2010 (Brazil, Ecuador, Lao People's Democratic Republic, Malaysia, Nigeria, Pakistan, Papua New Guinea, Peru, Thailand, Uganda and United Republic of Tanzania). One country (Chile) reported zero for FRA 2010 but some 900 ha for the FRA 2005 Study.

Together, the 21 countries that did report accounted for a total area of 16.7 million hectares. To this should be added an estimated 14.8 million hectares from the 12 missing

[8] Indonesia only reported an estimate for 2000. Due to a lack of other information, this figure was used for 2010 for this analysis.

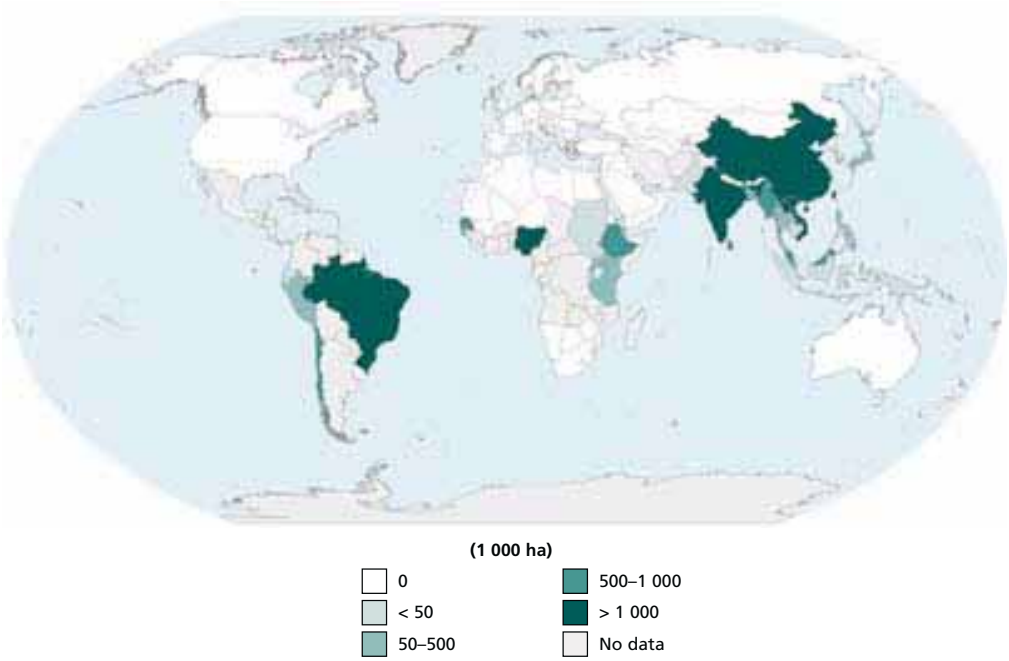
countries (based on information in FAO, 2007f), taking the total to some 31.5 million hectares globally (see Table 2.9 and Figure 2.12). This is lower than the global figure reported in FAO (2007f) (36.8 million hectares) despite the addition of the eight new countries, and the fact that Sir Lanka has revised its previous estimate upwards by more

TABLE 2.9
Trends in area of bamboo by country and region, 1990–2010

Country/region	Area of bamboo (1 000 ha)			
	1990	2000	2005	2010
Ethiopia**	1 000	1 000	1 000	1 000
Kenya	150	150	150	150
Mauritius	n.s.	n.s.	n.s.	n.s.
Nigeria*	1 590	1 590	1 590	1 590
Senegal	723	691	675	661
Sudan**	30	30	30	31
Uganda*	67	67	67	67
United Republic of Tanzania*	128	128	128	128
Total Africa	**3 688**	**3 656**	**3 640**	**3 627**
Bangladesh	90	86	83	186
Cambodia	31	31	36	37
China	3 856	4 869	5 426	5 712
India	5 116	5 232	5 418	5 476
Indonesia**	1	1	1	1
Japan	149	153	155	156
Lao People's Democratic Republic*	1 612	1 612	1 612	1 612
Malaysia*	422	592	677	677
Myanmar	963	895	859	859
Pakistan*	9	14	20	20
Philippines	127	156	172	188
Republic of Korea	8	6	7	8
Sri Lanka	1 221	989	742	742
Thailand*	261	261	261	261
Viet Nam	1 547	1 415	1 475	1 425
Total Asia	**15 412**	**16 311**	**16 943**	**17 360**
Total Europe	**0**	**0**	**0**	**0**
Cuba**	n.s.	n.s.	n.s.	2
El Salvador	n.s.	n.s.	n.s.	n.s.
Jamaica	34	34	34	34
Martinique	2	2	2	2
Trinidad and Tobago	1	1	1	1
Total North and Central America	**37**	**37**	**37**	**39**
Papua New Guinea*	23	38	45	45
Total Oceania	**23**	**38**	**45**	**45**
Brazil*	9 300	9 300	9 300	9 300
Chile*	900	900	900	900
Ecuador*	9	9	9	9
Peru*	190	190	190	190
Total South America	**10 399**	**10 399**	**10 399**	**10 399**
World	**29 560**	**30 442**	**31 065**	**31 470**

Notes:
* Data for 1990, 2000 and 2005 from FAO (2007f). Data for 2005 also used for 2010. For countries in South America, the figures for 2000 were also used for 1990.
** Gaps in data series filled by FAO estimates.
n.s. = not significant

FIGURE 2.12
Area of bamboo by country, 2010



Note: Information for Brazil, Chile, Ecuador, Lao People's Democratic Republic, Malaysia, Nigeria, Pakistan, Papua New Guinea, Peru, Thailand, Uganda and United Republic of Tanzania is based on FAO, 2007f.

than 700 thousand hectares. This is because India revised its estimate downwards by more than 5 million hectares and Indonesia by 2 million hectares.

Trends

Information was missing for 1990 and 2000 for Cuba, Ethiopia and Sudan. For these three countries, the figure for 2005 was used for 1990 and 2000 as well. Indonesia only reported an estimate for 2000 and, due to a lack of other information, this figure was used for all four reporting years.

Based only on the 21 countries that reported some bamboo resources for FRA 2010, the total area of bamboo has increased by some 1.6 million hectares (or close to 11 percent) since 1990. By also taking into account data from the FRA 2005 study, the increase was 2 million hectares. However, there is clearly a need for better internal communication and more accurate assessments of the area of bamboo in many countries.

Rubber plantations

Rubber trees (primarily *Hevea brasiliensis* originating from Brazil) have been planted in many countries over the past 100 years. Most rubber tree plantations are located in South and Southeast Asia and some also exist in tropical West Africa. Many of the early plantations are not very productive and the senescent trees are increasingly entering the wood production chain. Thailand in particular has carved out a niche market in toys and handicrafts made from rubber wood.

Status

A total of 169 countries, accounting for 84 percent of the total forest area reported on the area of rubber plantation. Of these, only 19 reported the existence of rubber plantations.

Annual statistics on the area harvested to produce natural rubber are collected by FAO as part of its agricultural statistics. In the FAOSTAT database, information is available for 28 countries. Combining the two sources of information yields a list of 32 countries, because four countries reported to FRA 2010 but are not included in FAOSTAT. Table 2.10 and Figure 2.13 show the combined list of countries and the estimated areas.[9] The FAOSTAT figures refer to 'area harvested' and are therefore likely

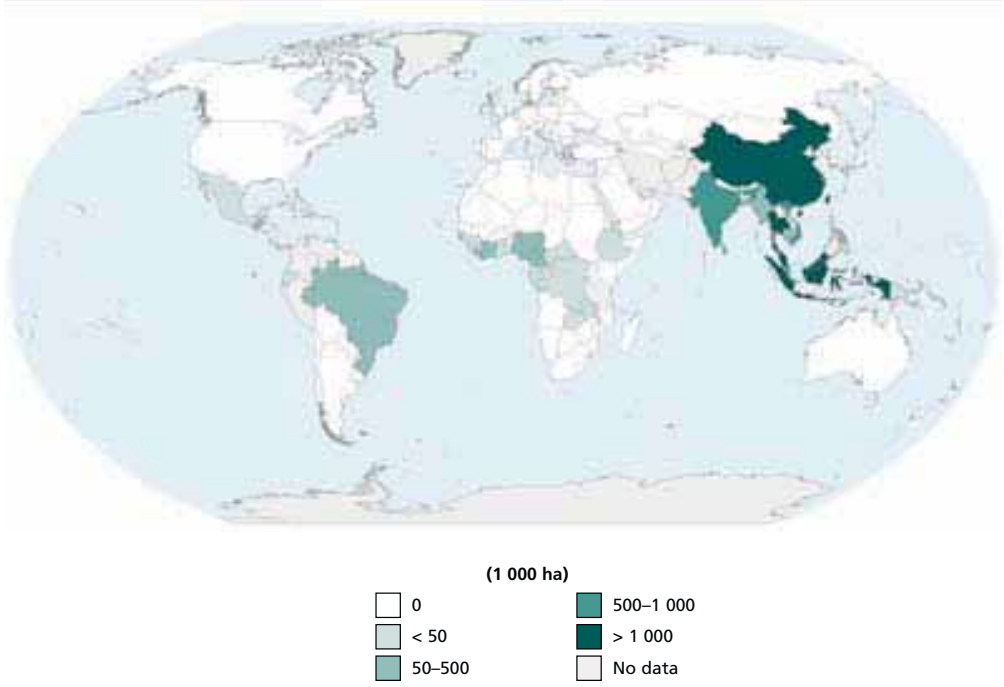
TABLE 2.10
Trends in area of rubber plantations by country and region, 1990–2010

Country/region	Area of rubber plantations (1 000 ha)			
	1990	2000	2005	2010
Cameroon*	39	43	49	52
Central African Republic*	1	1	1	1
Congo*	2	2	2	2
Côte d'Ivoire	60	84	120	120
Democratic Republic of the Congo*	41	19	15	15
Ethiopia**	1	1	1	1
Gabon	13	13	13	13
Ghana*	11	17	17	17
Guinea	1	4	6	6
Liberia	109	109	109	109
Malawi**	2	2	2	2
Nigeria*	223	319	339	340
Sierra Leone	2	2	2	2
Zambia	0	n.s.	n.s.	1
Total Africa	**506**	**615**	**676**	**680**
Bangladesh	20	35	35	8
Brunei Darussalam*	3	3	4	4
Cambodia	67	79	74	69
China	781	1 058	1 039	1 001
India	502	563	597	631
Indonesia*	1 860	2 441	2 826	2 898
Malaysia	1 836	1 431	1 229	1 132
Myanmar*	40	54	72	73
Philippines**	8	8	8	8
Sri Lanka	183	157	129	117
Thailand	1 908	1 993	2 202	2 591
Viet Nam	222	412	460	630
Total Asia	**7 431**	**8 234**	**8 674**	**9 161**
Total Europe	**0**	**0**	**0**	**0**
Dominican Republic*	n.s.	n.s.	n.s.	n.s.
Guatemala*	16	39	50	62
Mexico*	10	12	13	14
Total North and Central America	**10**	**12**	**13**	**14**
Papua New Guinea	16	20	22	24
Total Oceania	**16**	**20**	**22**	**24**
Brazil	64	97	116	174
Ecuador*	2	4	8	9
Total South America	**65**	**100**	**124**	**183**
World	**8 027**	**8 981**	**9 509**	**10 062**

Notes:
* Figures obtained from FAOSTAT.
** Missing data for two reporting years estimated by FAO.
n.s. = not significant

[9] To overcome the problem of erratic harvesting, five year averages were used from the FAOSTAT database for 1990, 2000 and 2005, with 2008 used as the best available estimate for 2010.

FIGURE 2.13
Area of rubber plantations by country, 2010



to result in an underestimate of the total area, as was also evident when comparing the two sources for countries that had reported to both processes. Nevertheless, the difference, in most cases, was relatively small.

At the global level, it is estimated that at least 10 million hectares of rubber plantations exist. The vast majority of these are located in Southeast Asia (Indonesia, Thailand and Malaysia) and in China.

Trends

Based on the information available, the area of rubber plantations has steadily increased by some 2 million hectares (or 25 percent) since 1990 (see Table 2.10). However, the area is decreasing in Malaysia and is expected to decrease even further in the future as older rubber plantations are being converted to other uses.

Conclusions

As a follow-up to the thematic studies on mangroves and bamboo undertaken for FRA 2005 and in order to obtain data on rubber plantations, which in some countries are not classified as forests, countries were asked to report separately on these three distinct forest types as part of FRA 2010. The results show that the area of mangroves is decreasing, while the area of bamboo and of rubber plantations is increasing. Although the response rate overall was fairly good, data were missing from some countries despite the fact that they had been reported in the FRA 2005 study or supplied to FAO's statistical database on agriculture (FAOSTAT). Furthermore, analysis of the existing data on trends suggests that these should be treated with caution, so there is clearly room for improvement in future assessments of the status and trends of these selected forest types.

GROWING STOCK

Introduction

Growing stock has formed part of the global forest resources assessments since the first report. In addition to providing information on existing wood resources, growing stock estimates form the basis for the estimation of biomass and carbon stocks for most countries.

Country information on total growing stock and forest area was used to estimate growing stock per hectare as an indicator of how well or poorly stocked the forests are. For FRA 2010 information was also collected on the proportion of broadleaved and coniferous tree species, and on the growing stock of commercial species.

Status

In total, 180 countries and areas, representing 94 percent of the world's forests, reported the total growing stock in forests for 2010. For the remaining countries and areas, FAO estimated total growing stock by taking subregional averages of growing stock per hectare and multiplying these by the forest area for the respective years.

In 2010, the estimated total growing stock in the world's forest amounted to 527 billion m^3. Table 2.11 and Figure 2.14 show that the growing stock per hectare is highest in the tropical moist forests of South America and Western and Central Africa, but is also high in temperate and boreal forests.

The composition of the growing stock, divided into broadleaved and coniferous species, was reported by 117 countries, representing 71 percent of the total forest area and 74 percent of the world's total growing stock. In 2010, about 39 percent of the total growing stock was coniferous and 61 percent broadleaved species. However, it is likely that in reality the share of broadleaved species is higher, as most of the countries that have not reported on growing stock distribution are developing countries with weak information, and in most of these countries coniferous species represent a very small part of the total growing stock. Coniferous species clearly dominate the growing stock in Europe, and North and Central America, while

TABLE 2.11
Growing stock by region and subregion, 2010

Region/subregion	Total growing stock (million m^3)	Growing stock (m^3/ha)
Eastern and Southern Africa	13 697	51
Northern Africa	1 346	17
Western and Central Africa	61 908	189
Total Africa	**76 951**	**114**
East Asia	21 337	84
South and Southeast Asia	29 031	99
Western and Central Asia	3 316	76
Total Asia	**53 685**	**91**
Europe excl. Russian Federation	30 529	156
Total Europe	**112 052**	**111**
Caribbean	584	84
Central America	2 891	148
North America	82 941	122
Total North and Central America	**86 416**	**123**
Total Oceania	**20 885**	**109**
Total South America	**177 215**	**205**
World	**527 203**	**131**

broadleaved species are predominant in Africa, Oceania and South America (see Figure 2.15).

A total of 112 countries, representing 64 percent of the total forest area and 67 percent of the world's total growing stock, reported on the growing stock of commercial species for 2010. The proportion of the total growing stock made up of commercial species is presented in Table 2.12.

FIGURE 2.14
Growing stock per hectare by country, 2010

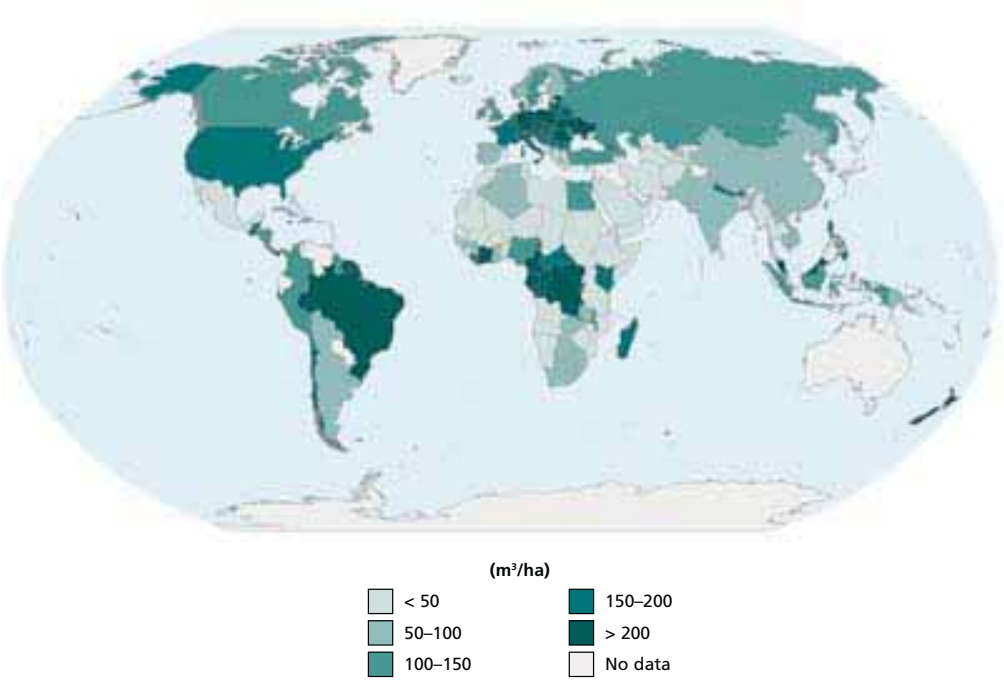
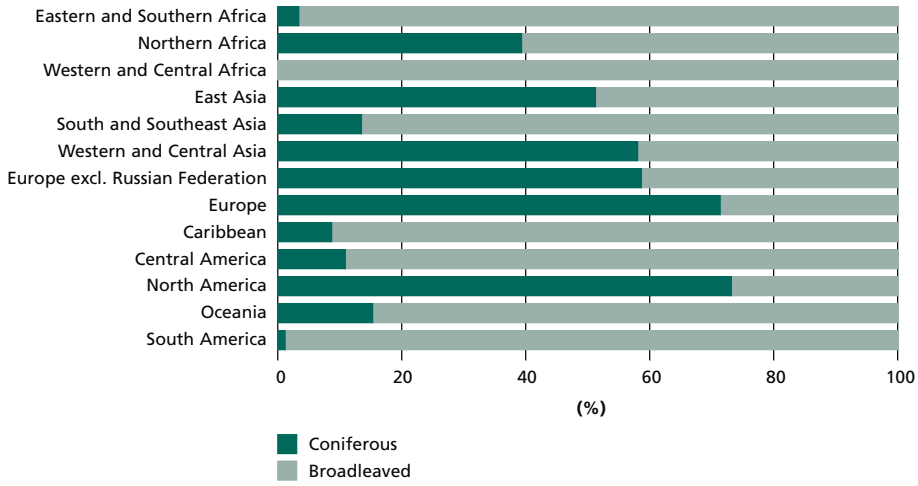


FIGURE 2.15
Growing stock composition by subregion, 2010



About 61 percent of the world's total growing stock is made up of commercial species. This includes all trees of commercial species, not only those that have reached commercial size or those growing on land available for wood supply. While countries in North America and Europe consider most of the growing stock to be commercial, less than half of the growing stock is considered to comprise commercial species in Africa, Asia and South America.

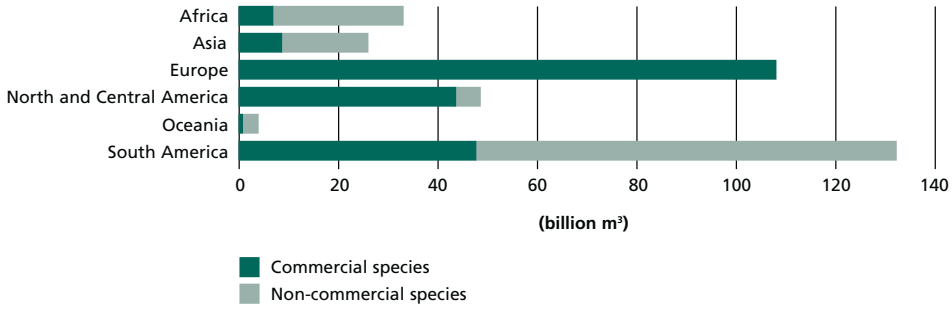
In absolute terms – and bearing in mind that the figures are based on countries representing only 67 percent of the world's total growing stock – the largest stocks of commercial species are found in Europe, South America, and North and Central America (see Figure 2.16). However, some large forest countries in Africa, Asia and Oceania did not provide data on growing stock of commercial species, so the totals shown are likely to be underestimates.

The global total growing stock on other wooded land in 2010 is estimated at about 15 billion m^3 or an average of about 13.1 m^3 per hectare. It should be noted however

TABLE 2.12:
Growing stock of commercial species by region and subregion, 2010

Region/subregion	Growing stock of commercial species (% of total)
Eastern and Southern Africa	16.5
Northern Africa	71.8
Western and Central Africa	21.6
Total Africa	**20.5**
East Asia	32.4
South and Southeast Asia	28.8
Western and Central Asia	53.9
Total Asia	**32.9**
Europe excl. Russian Federation	99.3
Total Europe	**99.8**
Caribbean	75.0
Central America	17.1
North America	91.5
Total North and Central America	**89.8**
Total Oceania	**16.5**
Total South America	**36.0**
World	**61.2**

FIGURE 2.16
Growing stock of commercial species by region, 2010



that country data on growing stock on other wooded land are generally weak and in most cases rough estimates were made based on limited inventory data.

Trends

In total, 175 countries and areas, representing 93 percent of the world's forests, reported a complete time series (1990, 2000, 2005 and 2010) for total growing stock in forests. For the remaining countries and areas FAO estimated total growing stock by taking subregional averages of growing stock per hectare and multiplying these by the forest area for the respective years. In a few cases, where only one or two data points were missing for a complete time series, the FAO estimates for the missing data points were based on the growing stock per hectare for the closest data point. By this procedure a complete dataset with no gaps was obtained, which has been used in further analysis.

A summary of growing stock by region and subregion is shown in Table 2.13, which indicates that there has been a small decline in total growing stock over the period 1990–2010. However, it is unlikely that this change (0.5 percent over 20 years) is significant in statistical terms.

Growing stock is strongly correlated to forest area, which means that if the forest area declines, so usually does the growing stock. Growing stock per hectare provides a better indication of whether forests are becoming more or less well stocked. Growing stock per hectare is increasing globally, particularly in North America and in Europe excluding the Russian Federation. The uneven trend for South and Southeast Asia is primarily a result of the data reported by Indonesia (which showed an increase in growing stock per hectare from 1992 to 1998 followed by a decrease between 1998 and 2003). This may be because the methods used in Indonesia were not fully compatible over time.

It is interesting to note that the growing stock figures presented in FRA 2010, including growing stock per hectare, are in general higher than those contained in

TABLE 2.13
Trends in growing stock in forest by region and subregion, 1990–2010

Region/subregion	Growing stock (million m³)				Growing stock (m³/ha)			
	1990	2000	2005	2010	1990	2000	2005	2010
Eastern and Southern Africa	15 300	14 486	14 091	13 697	50.3	50.7	50.9	51.2
Northern Africa	1 415	1 351	1 355	1 346	16.6	17.1	17.2	17.1
Western and Central Africa	66 319	64 067	63 009	61 908	184.3	186.5	187.7	188.7
Total Africa	**83 035**	**79 904**	**78 455**	**76 951**	**110.8**	**112.8**	**113.5**	**114.1**
East Asia	15 987	18 577	20 226	21 337	76.4	81.9	83.6	83.8
South and Southeast Asia	32 400	30 865	30 132	29 031	99.6	102.5	100.7	98.6
Western and Central Asia	2 949	3 101	3 204	3 316	71.1	73.5	74.7	76.2
Total Asia	**51 336**	**52 543**	**53 563**	**53 685**	**89.1**	**92.2**	**91.7**	**90.6**
Europe excl. Russian Federation	23 810	27 487	29 176	30 529	131.9	145.5	151.7	155.8
Total Europe	**103 849**	**107 757**	**109 655**	**112 052**	**105.0**	**107.9**	**109.5**	**111.5**
Caribbean	445	529	567	584	75.5	82.3	84.3	84.2
Central America	3 782	3 253	3 073	2 891	147.1	148.0	148.1	148.2
North America	74 913	76 925	79 924	82 941	110.7	113.6	117.9	122.2
Total North and Central America	**79 141**	**80 708**	**83 564**	**86 416**	**111.7**	**114.4**	**118.5**	**122.5**
Total Oceania	**21 293**	**21 415**	**21 266**	**20 885**	**107.1**	**108.0**	**108.1**	**109.1**
Total South America	**191 451**	**184 141**	**181 668**	**177 215**	**202.3**	**203.6**	**205.9**	**205.0**
World	**530 105**	**526 469**	**528 170**	**527 203**	**127.2**	**128.9**	**130.1**	**130.7**

the FRA 2005 report. This is because many countries have collected new and better data for FRA 2010, more countries have reported, and more effort has been made to help countries provide the best possible estimates with the weak data they often have available.

Table 2.14 shows trends in the relative share of coniferous and broadleaved species by region and subregion between 1990 and 2010. It is based on data from 110 countries and areas (representing 71 percent of the total forest area) which reported a complete time series of growing stock distributed by coniferous and broadleaved species. For most regions, the changes over time are minimal; however East Asia shows a clear trend towards a higher proportion of broadleaved species, primarily due to planting of broadleaved species in China. Europe shows a similar, but less pronounced, trend. The figures for Oceania exclude both Australia and New Zealand as neither provided a full time series.

A complete time series of the growing stock of commercial species was reported by 105 countries and areas, representing 64 percent of total forest area. Table 2.15 shows the proportion of the total growing stock made up of commercial species and how it changes over time. The slightly increasing global trend is unlikely to be significant in statistical terms. Most regions show no, or a very small, change. Only Asia demonstrates a clear declining trend in the proportion of commercial species in the total growing stock, despite the fact that the total growing stock is increasing over time in the region. This is primarily due to a decrease in the growing stock of commercial species reported by China.

A complete time series for growing stock on other wooded land was reported by 111 countries (including those that reported zero). For the remaining countries and areas, FAO estimated growing stock on other wooded land by taking the subregional averages of growing stock per hectare and multiplying these by the area of other wooded land for the respective years.

TABLE 2.14
Trends in growing stock composition by region and subregion, 1990–2010

Region/subregion	Coniferous species (% of total growing stock)				Broadleaved species (% of total growing stock)			
	1990	2000	2005	2010	1990	2000	2005	2010
Eastern and Southern Africa	3.9	3.6	3.4	3.4	96.1	96.4	96.6	96.6
Northern Africa	38.5	39.0	39.0	39.3	61.5	61.0	61.0	60.7
Western and Central Africa	0	0	0	0	100.0	100.0	100.0	100.0
Total Africa	**1.0**	**1.1**	**1.1**	**1.1**	**99.0**	**98.9**	**98.9**	**98.9**
East Asia	59.3	55.7	51.6	51.2	40.7	44.3	48.4	48.8
South and Southeast Asia	12.8	13.2	13.3	13.5	87.2	86.8	86.7	86.5
Western and Central Asia	57.9	58.2	58.0	58.0	42.1	41.8	42.0	42.0
Total Asia	**43.7**	**42.4**	**40.2**	**40.1**	**56.3**	**57.6**	**59.8**	**59.9**
Europe excl. Russian Federation	61.0	60.2	59.1	58.9	39.0	39.8	40.9	41.1
Total Europe	**75.2**	**69.3**	**69.4**	**71.4**	**24.8**	**30.7**	**30.6**	**28.6**
Caribbean	8.5	9.4	9.0	9.0	91.5	90.6	91.0	91.0
Central America	12.1	11.5	11.3	10.9	87.9	88.5	88.7	89.1
North America	72.9	69.4	70.1	73.1	27.1	30.6	29.9	26.9
Total North and Central America	**70.8**	**67.7**	**68.5**	**71.5**	**29.2**	**32.3**	**31.5**	**28.5**
Total Oceania	**0**	**0**	**0**	**0**	**100.0**	**100.0**	**100.0**	**100.0**
Total South America	**0.9**	**1.0**	**1.1**	**1.2**	**99.1**	**99.0**	**98.9**	**98.8**
World	**37.1**	**36.0**	**36.7**	**38.8**	**62.9**	**64.0**	**63.3**	**61.2**

Table 2.16 shows the growing stock on other wooded land. There are some variations in the time series, but most are unlikely to be statiscally significant. The decrease seen between 1990 and 2000 for the Russian Federation is likely to be a result of data reported on the extent of other wooded land for 1990 and 2000, for which the methods used may not be fully compatible.

TABLE 2.15
Trends in growing stock of commercial species by region and subregion, 1990–2010

Region/subregion	Commercial species (% of total growing stock)			
	1990	2000	2005	2010
Eastern and Southern Africa	16.2	16.4	16.4	16.5
Northern Africa	75.6	73.3	72.6	71.8
Western and Central Africa	20.7	21.0	21.3	21.6
Total Africa	**19.7**	**20.0**	**20.2**	**20.5**
East Asia	67.0	45.7	32.3	32.4
South and Southeast Asia	29.2	29.1	28.8	28.8
Western and Central Asia	66.6	64.9	58.9	53.8
Total Asia	**52.8**	**41.5**	**33.2**	**32.9**
Europe excl. Russian Federation	99.4	99.4	99.5	99.5
Total Europe	**99.9**	**99.9**	**99.9**	**99.9**
Caribbean	65.3	73.9	77.0	78.0
Central America	17.1	17.1	17.1	17.1
North America	89.8	91.6	91.6	91.5
Total North and Central America	**87.1**	**89.3**	**89.6**	**89.8**
Total Oceania	**51.2**	**51.2**	**51.2**	**51.2**
Total South America	**35.8**	**35.8**	**35.8**	**36.0**
World	**60.0**	**60.7**	**60.7**	**61.6**

TABLE 2.16
Trends in growing stock in other wooded land by region and subregion, 1990–2010

Region/subregion	Growing stock (million m^3)				Growing stock (m^3/ha)			
	1990	2000	2005	2010	1990	2000	2005	2010
Eastern and Southern Africa	3 266	3 086	2 995	2 907	15.4	15.0	14.7	14.5
Northern Africa	510	479	465	449	7.9	7.9	7.9	7.8
Western and Central Africa	1 794	1 722	1 690	1 662	16.0	16.8	17.3	17.8
Total Africa	**5 570**	**5 288**	**5 150**	**5 018**	**14.3**	**14.3**	**14.3**	**14.3**
East Asia	1 064	1 046	1 070	1 113	10.0	10.3	10.0	10.7
South and Southeast Asia	963	1 161	1 248	1 247	16.0	18.1	19.2	19.2
Western and Central Asia	195	190	185	184	3.0	2.8	2.8	2.7
Total Asia	**2 223**	**2 397**	**2 503**	**2 544**	**9.6**	**10.3**	**10.5**	**10.8**
Europe excl. Russian Federation	356	310	279	273	12.1	11.3	10.2	10.4
Total Europe	**1 961**	**1 903**	**1 931**	**2 048**	**25.5**	**19.2**	**19.2**	**20.6**
Caribbean	40	40	42	41	38.5	38.1	35.7	37.2
Central America	155	165	167	173	26.1	25.4	25.7	26.5
North America	229	228	228	227	1.8	1.8	1.8	1.8
Total North and Central America	**424**	**434**	**438**	**441**	**3.1**	**3.2**	**3.2**	**3.3**
Total Oceania	**2 367**	**2 399**	**2 431**	**2 463**	**16.5**	**16.7**	**16.9**	**17.2**
Total South America	**2 654**	**2 582**	**2 543**	**2 508**	**14.0**	**14.0**	**14.0**	**14.0**
World	**15 199**	**15 003**	**14 995**	**15 022**	**13.0**	**12.9**	**12.9**	**13.1**

Conclusions

The world's total growing stock in forests is 527 billion m^3 or 131 m^3/ha. The total growing stock shows a slightly decreasing trend caused by a global decrease in forest area. However, the growing stock per hectare is increasing globally – this is particularly the case in North America and in Europe excluding the Russian Federation. The growing stock per hectare is highest in the tropical forests of South America, and Western and Central Africa, but is also high in temperate and boreal forests. Total growing stock on other wooded land amounts to about 15 billion m^3 or 13 m^3/ha.

While the quality of the data has improved since FRA 2005 as more countries have conducted national forest inventories, the absence of reliable trend information is still an issue of concern. The vast majority of countries have only one estimate of growing stock per hectare and for these countries any changes in growing stock reflect only the changes in forest area.

For many countries, there is still no clear explanation of how the original country data on growing stock were obtained, and how related key parameters such as threshold values were used, volume equations applied and species included. More work is needed to further improve the quality and the comparability of the growing stock estimates.

BIOMASS

Introduction

Forest biomass, expressed in terms of dry weight of living organisms, is an important measure for analysing ecosystem productivity and also for assessing energy potential and the role of forests in the carbon cycle. Although closely correlated to – and often estimated directly from – growing stock it constitutes an important characteristic of the forest ecosystem and has formed part of the global forest resources assessments since FRA 1990.

Status

In total, 180 countries and areas, representing 94 percent of the world's forests, reported on biomass in forest for 2010. Dead wood was reported by 73 countries and areas representing 60 percent of the world's forests. For the remaining countries and areas, FAO estimated the biomass and dead wood by taking subregional averages per hectare and multiplying these by the forest area for the respective years.

Table 2.17 shows that in 2010 the total biomass (above-ground and below-ground) contained in the world's forests amounted to 600 Gt. This corresponds to about 149 tonnes per hectare. The highest biomass stock per hectare was found in regions with tropical forests, such as South America, and Western and Central Africa, where biomass stocks are over 200 tonnes per hectare. Dead wood in the world's forests was estimated to be about 67 Gt of dry matter or 16.6 tonnes per hectare.

The global estimates of biomass for FRA 2010 are higher than those for FRA 2005. This is mainly because the estimates of forest area are higher in FRA 2010 than in FRA 2005, but also because the biomass stock per hectare is slightly higher in FRA 2010.

The vast majority of countries have used the conversion factors provided by the IPCC to estimate biomass from growing stock. The relationships between growing stock, above-ground and below-ground biomass are therefore fairly constant over time. Table 2.18 shows the biomass conversion and expansion factor[10], the root–shoot ratio[11] and the dead–live ratio[12] by subregion based on the estimates of growing stock

[10] The biomass conversion and expansion factor is calculated as the above-ground biomass in tonnes divided by growing stock in m^3.

[11] The root–shoot ratio is calculated as below-ground biomass divided by above-ground biomass.

[12] The dead–live ratio is calculated as the dry weight of dead wood divided by the total living biomass (above-ground and below-ground).

TABLE 2.17
Biomass and dead wood stock by region and subregion, 2010

Region/subregion	Biomass		Dead wood	
	million tonnes	t/ha	million tonnes	t/ha
Eastern and Southern Africa	33 385	124.8	6 888	25.7
Northern Africa	3 711	47.1	1 069	13.6
Western and Central Africa	81 603	248.7	7 747	23.6
Total Africa	**118 700**	**176.0**	**15 704**	**23.3**
East Asia	18 429	72.4	2 514	9.9
South and Southeast Asia	51 933	176.4	5 964	20.3
Western and Central Asia	3 502	80.5	70	1.6
Total Asia	**73 864**	**124.7**	**8 548**	**14.4**
Europe excl. Russian Federation	25 602	130.7	1 434	7.3
Total Europe	**90 602**	**90.2**	**15 790**	**15.7**
Caribbean	1 092	157.5	120	17.2
Central America	3 715	190.5	419	21.5
North America	76 929	113.3	8 633	12.7
Total North and Central America	**81 736**	**115.9**	**9 172**	**13.0**
Total Oceania	**21 302**	**111.3**	**3 932**	**20.5**
Total South America	**213 863**	**247.4**	**13 834**	**16.0**
World	**600 066**	**148.8**	**66 980**	**16.6**

TABLE 2.18
Biomass conversion and expansion factor, root–shoot ratio and dead–live ratio by region and subregion, 2010

Region/subregion	Biomass conversion and expansion factor	Root–shoot ratio	Dead–live ratio
Eastern and Southern Africa	1.94	0.26	0.21
Northern Africa	2.15	0.28	0.29
Western and Central Africa	1.07	0.23	0.09
Total Africa	**1.24**	**0.24**	**0.13**
East Asia	0.66	0.31	0.14
South and Southeast Asia	1.43	0.30	0.11
Western and Central Asia	0.82	0.28	0.02
Total Asia	**1.08**	**0.30**	**0.12**
Europe excl. Russian Federation	0.67	0.26	0.06
Total Europe	**0.65**	**0.25**	**0.17**
Caribbean	1.51	0.24	0.11
Central America	1.04	0.24	0.11
North America	0.76	0.22	0.11
Total North and Central America	**0.78**	**0.22**	**0.11**
Total Oceania	**0.77**	**0.33**	**0.18**
Total South America	**0.99**	**0.20**	**0.06**
World	**0.92**	**0.24**	**0.11**

and biomass for 2010. As expected, the calculated factors are well within the range of default values presented in the latest IPCC Guidelines (IPCC, 2006).

Trends

In total, 174 countries and areas reported a complete time series for above-ground and below-ground biomass in forests. These countries represent more than 93 percent of

the global forest area. This is a considerable increase in reporting in comparison with FRA 2005 when 146 countries and areas provided information. For the remaining countries and areas, FAO estimated biomass by taking the subregional averages of biomass per hectare and multiplying them by forest area for the respective years.

Table 2.19 shows that, between 1990 and 2010, the global biomass stock decreased by about 23 Gt, or 3.6 percent globally. Africa and South America show the largest decrease in total stocks, mainly because of a decrease in forest area. In contrast, Europe and North America show an increase in total biomass stock.

Globally, biomass stock per hectare does not show any major changes for the period 1990–2010. South and Southeast Asia show a decrease in biomass stock per hectare, while Africa, Europe, North and Central America, and South America show a slight increase. With the exception of South and Southeast Asia, the trends in biomass stock per hectare follow the trends in growing stock per hectare.

Countries were asked to provide data on dead wood only if they had national data available, because the latest IPCC guidelines (IPCC, 2006) do not provide any default factors for estimating it. Consequently, the response rate for dead wood is low with complete time series data available for only 65 countries and areas, representing 59 percent of the world's forest area.[13] The estimates of dead wood are therefore much weaker than the biomass estimates. For the remaining countries and areas, FAO made estimates by taking the subregional averages of dead wood stock per hectare and multiplying them by the forest area for the respective years. Table 2.20 shows the estimated amount of dead wood in forests expressed in million tonnes dry matter. Dead wood stocks have decreased by about 3 Gt over the period 1990–2010, mainly due to the decrease in forest area.

TABLE 2.19
Trends in total biomass in forests by region and subregion, 1990–2010

Region/subregion	Total biomass in forest (million tonnes)				Biomass in forest (t/ha)			
	1990	2000	2005	2010	1990	2000	2005	2010
Eastern and Southern Africa	37 118	35 232	34 304	33 385	122.0	123.2	124.0	124.8
Northern Africa	3 931	3 721	3 731	3 711	46.2	47.0	47.2	47.1
Western and Central Africa	88 340	84 886	83 275	81 603	245.5	247.2	248.0	248.7
Total Africa	**129 390**	**123 839**	**121 309**	**118 700**	**172.7**	**174.8**	**175.4**	**176.0**
East Asia	13 877	16 185	17 563	18 429	66.3	71.4	72.6	72.4
South and Southeast Asia	60 649	57 111	54 904	51 933	186.4	189.6	183.4	176.4
Western and Central Asia	3 063	3 236	3 355	3 502	73.8	76.7	78.2	80.5
Total Asia	**77 589**	**76 532**	**75 822**	**73 864**	**134.7**	**134.2**	**129.8**	**124.7**
Europe excl. Russian Federation	19 866	22 630	24 097	25 602	110.0	119.8	125.3	130.7
Total Europe	**84 874**	**86 943**	**88 516**	**90 602**	**85.8**	**87.1**	**88.4**	**90.2**
Caribbean	822	987	1 060	1 092	139.3	153.4	157.5	157.5
Central America	4 803	4 145	3 931	3 715	186.7	188.6	189.5	190.5
North America	72 518	74 453	75 646	76 929	107.2	110.0	111.6	113.3
Total North and Central America	**78 143**	**79 585**	**80 637**	**81 736**	**110.3**	**112.8**	**114.3**	**115.9**
Total Oceania	**22 095**	**21 989**	**21 764**	**21 302**	**111.2**	**110.8**	**110.6**	**111.3**
Total South America	**230 703**	**222 251**	**217 504**	**213 863**	**243.8**	**245.8**	**246.5**	**247.4**
World	**622 794**	**611 140**	**605 553**	**600 066**	**149.4**	**149.6**	**149.1**	**148.8**

[13] This does not imply that 65 countries have national data on dead wood – some countries decided to report the same stock as they reported to FRA 2005 based on the default factors in the IPCC 2003 Good Practice Guidance (IPCC, 2003).

TABLE 2.20
Trends in dead wood stocks by region and subregion, 1990–2010

Region/subregion	Dead wood stock (million tonnes)				Dead wood (t/ha)			
	1990	2000	2005	2010	1990	2000	2005	2010
Eastern and Southern Africa	7 836	7 362	7 126	6 888	25.8	25.8	25.8	25.7
Northern Africa	1 019	1 024	1 059	1 069	12.0	12.9	13.4	13.6
Western and Central Africa	8 740	8 271	8 019	7 747	24.3	24.1	23.9	23.6
Total Africa	**17 595**	**16 658**	**16 205**	**15 704**	**23.5**	**23.5**	**23.4**	**23.3**
East Asia	1 920	2 193	2 362	2 514	9.2	9.7	9.8	9.9
South and Southeast Asia	7 435	6 491	6 257	5 964	22.8	21.6	20.9	20.3
Western and Central Asia	65	69	69	70	1.6	1.6	1.6	1.6
Total Asia	**9 420**	**8 753**	**8 689**	**8 548**	**16.4**	**15.4**	**14.9**	**14.4**
Europe excl. Russian Federation	1 261	1 348	1 391	1 434	7.0	7.1	7.2	7.3
Total Europe	**15 456**	**15 371**	**15 355**	**15 790**	**15.6**	**15.4**	**15.3**	**15.7**
Caribbean	89	105	113	120	15.0	16.4	16.8	17.2
Central America	552	472	441	419	21.5	21.5	21.3	21.5
North America	8 072	8 334	8 474	8 633	11.9	12.3	12.5	12.7
Total North and Central America	**8 713**	**8 911**	**9 029**	**9 172**	**12.3**	**12.6**	**12.8**	**13.0**
Total Oceania	**4 050**	**4 045**	**4 032**	**3 932**	**20.4**	**20.4**	**20.5**	**20.5**
Total South America	**14 838**	**14 353**	**14 233**	**13 834**	**15.7**	**15.9**	**16.1**	**16.0**
World	**70 072**	**68 089**	**67 542**	**66 980**	**16.8**	**16.7**	**16.6**	**16.6**

Conclusions

The world's forests contain 600 Gt of biomass (above-ground and below-ground) and about 67 Gt of dead wood. The decrease in total biomass stock is mainly a result of the loss of forest area.

While data availability and quality have improved since FRA 2005, trend data are still weak. Biomass is usually estimated by applying conversion factors to growing stock. However, the majority of countries do not have time series data on growing stock so the weaknesses in growing stock trend estimates are also directly translated into biomass. Data on dead wood dry matter are very weak and are unlikely to improve until the IPCC provides new and better default values and conversion factors.

CARBON STOCK

Introduction

Forests, like other ecosystems, are affected by climate change. In some places, impacts may be negative, while in others they may be positive. Forests also influence climate and the climate change process. They absorb carbon in wood, leaves and soil and release it into the atmosphere when burned, for example during forest fires or when forest land is cleared.

The Kyoto protocol and the UNFCCC request all member countries to assess and report national greenhouse gas emissions regularly, including emissions and removals of carbon reflected as stock changes in forests. To this end, the IPCC has developed guidelines, methods and default values for the parameters needed to assess carbon stocks and their changes in forests (IPCC, 2006). It has thus provided all countries with the means of estimating and reporting carbon stocks, greenhouse gas emissions and removals, irrespective of the availability of country-specific data. In order to maximize synergies and streamline country reporting to international organizations, FAO incorporated the IPCC 2006 guidelines on assessment of carbon stocks in forests into its guidelines for country reporting for FRA 2010.

Quantifying the substantial roles of forests as carbon stores, as sources of carbon emissions and as carbon sinks has become one of the keys to understanding and influencing the global carbon cycle. Global forest resources assessments have the potential to contribute to, or substantiate, the estimates of the magnitude of carbon stocks and flows made by scientific bodies such as IPCC. At the same time, they complement and facilitate international reporting by countries on greenhouse gas emissions and removals under the UNFCCC.

Figures on carbon stocks in forests reported under the UNFCCC, the Kyoto Protocol and to FAO are not necessarily identical. Forest definitions may vary and furthermore UNFCCC members are requested to report on 'managed forests' which may comprise all or only part of the forest area of a given country. FRA specific methods such as calibration, reclassification, estimating and forecasting are also not always implemented in exactly the same way in the reporting under the UNFCCC and the Kyoto Protocol.

Status

In total, 180 countries and areas, representing 94 percent of the world's forests, reported on carbon in biomass for 2010. For carbon in dead wood the corresponding figures are 72 countries (61 percent), for carbon in litter 124 countries (78 percent) and for soil carbon 121 countries (78 percent). For the remaining countries and areas, FAO estimated the carbon stocks by taking subregional averages per hectare and multiplying these by the forest area for the respective years.

Table 2.21 shows the estimated carbon stock in forests by region, subregion and at a global level. In 2010, the total carbon stock in the biomass of the world's forests is estimated at 289 Gt. For most countries, carbon in biomass merely reflects the biomass stock as the default carbon fraction from the IPCC guidelines has been used. In FRA 2010, most countries used a carbon fraction of 0.47 (as in the 2006 IPCC Guidelines), while some countries used the carbon fraction of 0.5 suggested in the

TABLE 2.21
Carbon stock in forest by region and subregion, 2010

Region/subregion	Carbon in biomass		Carbon in dead wood and litter		Carbon in soil		Total carbon stock	
	million tonnes	t/ha	million tonnes	t/ha	million tonnes	t/ha	million tonnes	t/ha
Eastern and Southern Africa	15 762	58.9	3 894	14.6	12 298	46.0	31 955	119.4
Northern Africa	1 747	22.2	694	8.8	2 757	35.0	5 198	66.0
Western and Central Africa	38 349	116.9	3 334	10.2	19 406	59.1	61 089	186.2
Total Africa	**55 859**	**82.8**	**7 922**	**11.7**	**34 461**	**51.1**	**98 242**	**145.7**
East Asia	8 754	34.4	1 836	7.2	17 270	67.8	27 860	109.4
South and Southeast Asia	25 204	85.6	1 051	3.6	16 466	55.9	42 722	145.1
Western and Central Asia	1 731	39.8	546	12.6	1 594	36.6	3 871	89.0
Total Asia	**35 689**	**60.2**	**3 434**	**5.8**	**35 330**	**59.6**	**74 453**	**125.7**
Europe excl. Russian Federation	12 510	63.9	3 648	18.6	18 924	96.6	35 083	179.1
Total Europe	**45 010**	**44.8**	**20 648**	**20.5**	**96 924**	**96.4**	**162 583**	**161.8**
Caribbean	516	74.4	103	14.8	416	60.0	1 035	149.2
Central America	1 763	90.4	714	36.6	1 139	58.4	3 616	185.4
North America	37 315	55.0	26 139	38.5	39 643	58.4	103 097	151.8
Total North and Central America	**39 594**	**56.1**	**26 956**	**38.2**	**41 198**	**58.4**	**107 747**	**152.7**
Total Oceania	**10 480**	**54.8**	**2 937**	**15.3**	**8 275**	**43.2**	**21 692**	**113.3**
Total South America	**102 190**	**118.2**	**9 990**	**11.6**	**75 473**	**87.3**	**187 654**	**217.1**
World	**288 821**	**71.6**	**71 888**	**17.8**	**291 662**	**72.3**	**652 371**	**161.8**

IPCC 2003 Good Practice Guidance. A few countries have used country-specific carbon fractions for their estimates. Globally, the average carbon fraction used is 0.48 with minor variations between subregions.

The total carbon stock in dead wood and litter in 2010 amounts to 72 billion tonnes or 17.8 tonnes per hectare. This is slightly more than reported in FRA 2005. However, data on carbon stock in dead wood and litter are still very weak. Most countries do not have national data on these carbon pools, so until the IPCC provides better default values, estimates of these carbon pools will continue to be weak.

The total stock of carbon in soil is estimated at 292 billion tonnes or 72.3 tonnes per hectare. This is slightly more than the total carbon stock in forest biomass.

Taking together all carbon in biomass, dead wood, litter and soils, the estimated total carbon stock in forests in 2010 is 652 billion tonnes, corresponding to 161.8 tonnes per hectare.

Trends

In total, 174 countries and areas (representing 93 percent of the total forest area) have reported a complete time series on carbon stock in forest biomass (above-ground and below-ground). For the remaining countries and areas, FAO estimated carbon stock in forest biomass by taking the subregional averages of carbon stock per hectare and multiplying them by the forest area for the respective years.

Table 2.22 shows the trends in estimated carbon stock in forest biomass by subregion, region and at the global level for the period 1990–2010. The total carbon stock in the biomass of the world's forests shows a decrease of about 10 Gt for the period 1990–2010 or -0.5 Gt per year on average, mainly due to a reduction in the world's forest area. As for biomass, the carbon stock per hectare does not show any significant change at the global level.

For dead wood carbon the response rate for FRA 2010 was lower than in FRA 2005, mainly because of the IPCC's decision to omit default conversion factors from the latest version of their guidelines. A complete time series on carbon in dead wood was reported by 66 countries and areas (representing 61 percent of the world's forest area).

TABLE 2.22
Trends in carbon stocks in forest biomass by region and subregion, 1990–2010

Region/subregion	Carbon in forest biomass (million tonnes)				Carbon in forest biomass (t/ha)			
	1990	2000	2005	2010	1990	2000	2005	2010
Eastern and Southern Africa	17 524	16 631	16 193	15 762	57.6	58.2	58.5	58.9
Northern Africa	1 849	1 751	1 756	1 747	21.7	22.1	22.2	22.2
Western and Central Africa	41 525	39 895	39 135	38 349	115.4	116.2	116.6	116.9
Total Africa	**60 898**	**58 277**	**57 083**	**55 859**	**81.3**	**82.2**	**82.6**	**82.8**
East Asia	6 592	7 690	8 347	8 754	31.5	33.9	34.5	34.4
South and Southeast Asia	29 110	27 525	26 547	25 204	89.5	91.4	88.7	85.6
Western and Central Asia	1 511	1 599	1 658	1 731	36.4	37.9	38.7	39.8
Total Asia	**37 213**	**36 814**	**36 553**	**35 689**	**64.6**	**64.6**	**62.6**	**60.2**
Europe excl. Russian Federation	9 699	11 046	11 763	12 510	53.7	58.5	61.2	63.9
Total Europe	**42 203**	**43 203**	**43 973**	**45 010**	**42.7**	**43.3**	**43.9**	**44.8**
Caribbean	387	466	500	516	65.5	72.4	74.4	74.4
Central America	2 279	1 969	1 865	1 763	88.6	89.6	89.9	90.4
North America	35 100	36 073	36 672	37 315	51.9	53.3	54.1	55.0
Total North and Central America	**37 766**	**38 508**	**39 038**	**39 594**	**53.3**	**54.6**	**55.3**	**56.1**
Total Oceania	**10 862**	**10 816**	**10 707**	**10 480**	**54.7**	**54.5**	**54.4**	**54.8**
Total South America	**110 281**	**106 226**	**103 944**	**102 190**	**116.5**	**117.5**	**117.8**	**118.2**
World	**299 224**	**293 843**	**291 299**	**288 821**	**71.8**	**71.9**	**71.7**	**71.6**

For carbon in litter the response rate was much higher than in FRA 2005 when only 54 countries reported. For FRA 2010, 119 countries (accounting for 77 percent of the world's forest area) reported on carbon in litter. For the remaining countries and areas, FAO estimated carbon stocks by taking the subregional average carbon stocks per hectare and multiplying them by the forest area for the respective years. Table 2.23 shows trends in carbon stocks of dead wood and litter combined for the period 1990–2010.

A complete time series on soil carbon was reported by 117 countries and areas (representing 78 percent of the world's forest area). This is a substantially larger response rate than in FRA 2005 when only 43 countries reported. For the remaining countries and areas, FAO made estimates by taking the subregional average soil carbon stocks per hectare and multiplying these by the forest area for the respective years. Most countries have used IPCC default values of stocks per hectare which relate to a soil depth of 30 cm. In this analysis, no adjustment has been made for countries reporting soil carbon to non-standard soil depths.

The declining trend in the total stock of carbon in the soil for the period 1990–2010 (see Table 2.24) is attributed to the loss of forest area during this period as the stocks per hectare show almost no change.

Table 2.25 summarizes the FRA 2010 global estimates of carbon stocks in forest.

The estimated total carbon stock in forests in 2010 is 652 billion tonnes, which equates to 161.8 tonnes per hectare. The total carbon stock has decreased during the period 1990–2010, mainly as a result of the loss of forest area during the period. Carbon stocks per hectare show a slight increase, but it is unlikely to be significant in statistical terms.

FRA 2010 shows slightly higher carbon stocks than those estimated for FRA 2005. This is mostly because forest area is estimated to be higher in FRA 2010 compared with FRA 2005. The stocks per hectare are almost the same, but while FRA 2005 presented a decreasing trend in stocks per hectare, FRA 2010 shows almost no change over time.

TABLE 2.23
Trends in carbon stocks in dead wood and litter combined, by region and subregion, 1990–2010

Region/subregion	Carbon in dead wood and litter (million tonnes)				Carbon in dead wood and litter (t/ha)			
	1990	2000	2005	2010	1990	2000	2005	2010
Eastern and Southern Africa	4 419	4 156	4 025	3 894	14.5	14.5	14.5	14.6
Northern Africa	674	668	688	694	7.9	8.4	8.7	8.8
Western and Central Africa	4 118	3 761	3 542	3 334	11.4	11	10.6	10.2
Total Africa	**9 211**	**8 586**	**8 255**	**7 922**	**12.3**	**12.1**	**11.9**	**11.7**
East Asia	1 428	1 608	1 729	1 836	6.8	7.1	7.1	7.2
South and Southeast Asia	1 134	1 069	1 067	1 051	3.5	3.6	3.6	3.6
Western and Central Asia	502	517	530	546	12.1	12.2	12.4	12.6
Total Asia	**3 064**	**3 194**	**3 325**	**3 434**	**5.3**	**5.6**	**5.7**	**5.8**
Europe excl. Russian Federation	3 337	3 495	3 561	3 648	18.5	18.5	18.5	18.6
Total Europe	**20 254**	**20 223**	**20 259**	**20 648**	**20.5**	**20.3**	**20.2**	**20.5**
Caribbean	72	89	97	103	12.2	13.8	14.3	14.8
Central America	929	799	756	714	36.1	36.4	36.4	36.6
North America	25 590	25 621	25 932	26 139	37.8	37.8	38.3	38.5
Total North and Central America	**26 591**	**26 510**	**26 784**	**26 956**	**37.5**	**37.6**	**38**	**38.2**
Total Oceania	**3 027**	**3 025**	**3 014**	**2 937**	**15.2**	**15.3**	**15.3**	**15.3**
Total South America	**10 776**	**10 382**	**10 154**	**9 990**	**11.4**	**11.5**	**11.5**	**11.6**
World	**72 923**	**71 919**	**71 792**	**71 888**	**17.5**	**17.6**	**17.7**	**17.8**

TABLE 2.24
Trends in carbon stocks in forest in soil by region and subregion, 1990–2010

Region/subregion	Carbon in soil (million tonnes)				Carbon in soil (t/ha)			
	1990	2000	2005	2010	1990	2000	2005	2010
Eastern and Southern Africa	13 871	13 084	12 690	12 298	45.6	45.8	45.9	46.0
Northern Africa	2 952	2 748	2 771	2 757	34.7	34.7	35.1	35.0
Western and Central Africa	21 083	20 223	19 814	19 406	58.6	58.9	59.0	59.1
Total Africa	**37 907**	**36 055**	**35 275**	**34 461**	**50.6**	**50.9**	**51.0**	**51.1**
East Asia	14 220	15 402	16 432	17 270	68.0	67.9	67.9	67.8
South and Southeast Asia	18 071	16 760	16 701	16 466	55.5	55.7	55.8	55.9
Western and Central Asia	1 534	1 550	1 564	1 594	37.0	36.7	36.5	36.6
Total Asia	**33 826**	**33 712**	**34 698**	**35 330**	**58.7**	**59.1**	**59.4**	**59.6**
Europe excl. Russian Federation	17 503	18 495	18 632	18 924	97.0	97.9	96.9	96.6
Total Europe	**95 503**	**96 495**	**96 632**	**96 924**	**96.5**	**96.7**	**96.5**	**96.4**
Caribbean	354	386	403	416	59.9	59.9	60.0	60.0
Central America	1 511	1 287	1 212	1 139	58.7	58.6	58.4	58.4
North America	39 752	39 645	39 613	39 643	58.7	58.6	58.4	58.4
Total North and Central America	**41 617**	**41 318**	**41 229**	**41 198**	**58.7**	**58.6**	**58.5**	**58.4**
Total Oceania	**8 584**	**8 533**	**8 490**	**8 275**	**43.2**	**43.0**	**43.2**	**43.2**
Total South America	**82 989**	**78 961**	**76 909**	**75 473**	**87.7**	**87.3**	**87.2**	**87.3**
World	**300 425**	**295 073**	**293 232**	**291 662**	**72.1**	**72.2**	**72.2**	**72.3**

TABLE 2.25
Trends in total carbon stocks in forests, 1990–2010

	Total carbon stock (million tonnes)				Carbon stock (t/ha)			
	1990	2000	2005	2010	1990	2000	2005	2010
Carbon in biomass	299 224	293 843	291 299	288 821	71.8	71.9	71.7	71.6
Carbon in dead wood	34 068	33 172	32 968	32 904	8.2	8.1	8.1	8.2
Carbon in litter	38 855	38 748	38 825	38 984	9.3	9.5	9.6	9.7
Carbon in soil	300 425	295 073	293 232	291 662	72.1	72.2	72.2	72.3
Total carbon stock	**672 571**	**660 836**	**656 323**	**652 371**	**161.4**	**161.8**	**161.6**	**161.8**

Conclusions

The world's forests store more than 650 billion tonnes of carbon, 44 percent in the biomass, 11 percent in dead wood and litter, and 45 percent in the soil. Globally carbon stocks are decreasing as a result of the loss of forest area; however the carbon stock per hectare has remained almost constant for the period 1990–2010. According to these estimates, the world's forest is therefore a net source of emissions due to the decrease in total forest area.

Data availability and quality have improved since FRA 2005, but there are still some issues of concern. As with growing stock and biomass, trend data are weak as most countries only have national data on growing stock for one point in time. This means that changes in stocks merely reflect changes in forest area. Default carbon values for dead wood were omitted from the 2006 IPCC Guidelines and the default values on carbon in litter are very rough. For soil carbon there are some issues related to the data from countries that estimate carbon to different soil depths. Finally, some countries with large areas of forested peat land have had difficulties assessing soil carbon using the IPCC guidelines.

Chapter 3

Forest biological diversity

OVERVIEW

Biological diversity encompasses the variety of existing life forms, the ecological roles they perform and the genetic diversity they contain (FAO, 1989). In forests, biological diversity allows species to evolve and dynamically adapt to changing environmental conditions (including climate), to maintain the potential for tree breeding and improvement (to meet human needs for goods and services, and changing end-use requirements) and to support their ecosystem functions.

While timber production often dominated the way in which forests were managed in the twentieth century, new pressures in the twenty-first century demand a more balanced approach that provides multiple goods and services. Progress towards sustainable forest management is now considered consistent with the conservation of biological diversity.

Assessing, monitoring and reporting on biological diversity are important activities aimed at guiding sustainable forest management. Monitoring of biological diversity – and the changes caused by forestry and other practices – is important in assessing the effectiveness of management and the cumulative changes brought about by forest use. However, there are conceptual and practical difficulties in measuring it. These are not unique to biological diversity *per se*, but are general inventory problems for variables in which target parameters are complex and highly variable.

Assessments of biological diversity can be made at a range of different scales that require different methodologies. These scales include ecosystems, landscapes, species, populations, individuals and genes. Varying and complex interactions exist among all these levels.

Because biological diversity encompasses the complexity of all life forms, assessment and monitoring are only possible for specific aspects or particular, defined goals. There is no single, objective measure of biological diversity, only proxy measures appropriate for specific and, by necessity, restricted purposes. Species richness, for example, has a very wide natural variation from boreal to tropical forests.

For policy and monitoring purposes, it is the change in biological diversity that is important, which implies identifying the relevant indicators and then monitoring them over time. So far this has not been achieved for forest ecosystems on a wide scale (i.e. national or continental). Most local forest inventories are conducted to estimate forest area and harvestable volumes of wood and sometimes NWFPs, rather than to monitor biological diversity. There is an immediate need to categorize – and substantially improve the understanding of – biological diversity with a view to measuring trends, particularly on regional scales.

In recent years, the Global Forest Resources Assessment has increased its focus on forest biological diversity. For FRA 2000, data were compiled on the proportion of forests in protected areas. Relevant information was compiled at the landscape and species levels for FRA 2005, while some structural and compositional aspects were also addressed. At the ecosystem level, for FRA 2005 countries provided information on the area of forests and, more specifically, on the area of primary forests and on forests designated for the conservation of biological diversity (including protected areas). At the species level, for FRA 2005 FAO focused on the assessment of the number of both native and endangered forest tree species at the country level. In addition, country

reports included lists of the ten most common tree species (measured by their share of total growing stock), thus providing important information on the tree species composition of forests.

The variables measured for FRA 2010 with relevance to forest biological diversity include:

- area of primary forests;
- forest area designated primarily for conservation of biological diversity;
- area of forests in protected areas;
- tree species composition of forests.

Although the second and third variables above are similar, the area of forest designated for the conservation of biological diversity is not necessarily equivalent to the area of forest in protected areas. This is because some protected areas may be designated for reasons other than the conservation of biological diversity, such as the protection of soil and water resources, or cultural heritage. At the same time, forests may be designated and managed primarily for the conservation of biological diversity without forming part of a protected area network.

In addition to the variables related to forest biological diversity presented and analysed here, Chapter 2 provides information on trends in the characteristics of forests – including the extent of selected forest types; Chapter 4 contains information on woody invasive species; and Chapter 5 presents an analysis of the use of introduced species in planted forests.

A study on the state of the world's forest genetic resources is currently underway and, once completed, will help fill an important information gap (see Box 3.1).

KEY FINDINGS

Primary forests account for 36 percent of forest area – but have decreased by more than 40 million hectares since 2000

Globally, more than one-third of all forest is classified as primary forest. This is defined as forest of native species where there are no clearly visible indications of human activities and the ecological processes have not been significantly disturbed. Primary forests, in particular tropical moist forests, include some of the world's most species-rich, diverse terrestrial ecosystems. The area of primary forest decreased by about 0.4 percent annually over the last ten years, largely as a result of the reclassification of primary forest to 'other naturally regenerated forest' because of selective logging and other human interventions.

Twelve percent of the world's forests are designated primarily for the conservation of biological diversity

The area of forest where conservation of biological diversity is designated as the primary function has increased by more than 95 million hectares since 1990, of which the largest part (46 percent) was designated between 2000 and 2005. These forests now account for 12 percent of the total forest area or more than 460 million hectares. Most, but not all, of them are located inside protected areas.

Legally established protected areas cover an estimated 13 percent of the world's forests

National parks, game reserves, wilderness areas and legally established protected areas cover more than 10 percent of the total forest area in most countries and regions. The primary function of these forests may be the conservation of biological diversity, the protection of soil and water resources, or the conservation of cultural heritage. The area of forest within protected area systems has increased by 94 million hectares since 1990. Two-thirds of this increase has been since 2000.

Analysis of data on growing stock composition can provide proxy indicators of forest tree species richness and relative abundance

This is useful for qualitative assessment and monitoring of biological diversity. While the growing stock of the ten most common tree species represents more than 90 percent of the total growing stock in many countries in the temperate and boreal zone, it represents less than 20 percent of total growing stock in tropical countries with high species diversity. The availability and comparability of information remains poor, however.

KEY CONCLUSIONS

Data collected for FRA 2010 show a continued positive trend in efforts to conserve forest biological diversity, as measured by quantitative indicators such as the area of forest designated primarily for the conservation of biological diversity and the area of forest in protected areas, which are both steadily increasing. However, the area of primary forest continues to decline.

Although information on growing stock composition is a useful proxy indicator of species richness and abundance, other indicators need to be determined or tested for use in qualitative assessments, which are necessary to monitor forest biological diversity. The preparation of the first report on *The State of the World's Forest Genetic Resources* (see Box 3.1) should contribute to the definition of additional indicators for monitoring forest biological diversity and the effectiveness of conservation measures.

BOX 3.1

Reporting on the *State of the World's Forest Genetic Resources*

Genetic diversity provides the fundamental basis for the evolution of forest tree species and for their adaptation to change. Conserving forest genetic resources is therefore vital, as they are a unique and irreplaceable resource for the future.

Forest genetic resources management can be effective only if treated as an integral element of overall sustainable forest management. Conservation concerns should be integrated into broader national and local development programmes, such as national forest programmes, rural development plans and poverty reduction strategies, which promote cooperation among sectors.

However, there is no consolidated global picture on the status and trends of forest genetic resources, and estimates of the rate of genetic diversity loss are lacking. This limits the capacity of countries and the international community to integrate forest genetic resources management into overall cross-cutting policies. It is recognized that reliable general data on forest status and trends are of great importance for the efficient management of forest genetic resources. Forest-related information, however, largely refers to forest resources in general rather than to forest diversity and variation. The availability of specific information on the status and trends in forest genetic resources is currently woefully inadequate.

The Commission on Genetic Resources for Food and Agriculture of FAO acknowledged the urgency of conserving and sustainably utilizing forest genetic resources. With the support of the Committee on Forestry, the Commission requested that a *State of the World's Forest Genetic Resources* report be prepared and presented to the Commission in 2013. The preparation of such a report was welcomed by the ninth meeting of the Conference of the Parties to the CBD.

The *State of the World's Forest Genetic Resources* will be prepared through a country-driven approach based on country reports and thematic studies. The Global Forest Resources Assessment process will serve as a model, and the two processes will be linked.

AREA OF PRIMARY FORESTS

Introduction

Information on total forest area, forest characteristics and the change in these over time is presented in Chapter 2, Extent of Forest Resources. This section focuses on primary forests, which are defined in FRA 2010 as forests of native species, in which there are no clearly visible indications of human activity and the ecological processes have not been significantly disturbed.

Primary forests are often equated with high levels of biological diversity, but this is not always the case. In the boreal zones and the arid tropics, for example, they can be poor in terms of numbers of plant and animal species, while some modified natural forests and forests interspersed with agricultural areas may provide additional habitats and thus harbour more species. Nevertheless, the size of the area of primary forest is an important indicator of the state of forest ecosystems.

It should also be kept in mind that primary forests fulfil many essential functions other than the conservation of biological diversity, such as protection of soil and water resources, carbon sequestration and the provision of aesthetic, cultural and religious values.

Status

Of the 233 countries and areas reporting for FRA 2010, 200 countries, accounting for 94 percent of total forest area, reported on the area of primary forest. Globally, close to 1.4 billion hectares, were classified as primary forest, which represents over one-third (36 percent) of total forest area of the reporting countries. However, information was missing for many of the smaller islands and territories, as well as for countries such as Cameroon and the Democratic Republic of the Congo (two of the largest countries in the Congo Basin, the second largest expanse of tropical forest) and for the Bolivarian Republic of Venezuela, so the actual area is probably slightly higher. Several countries reported that they had insufficient information on the area of primary forests, so they included it in the category of other naturally regenerated forests. Others used

TABLE 3.1
Area of primary forest by region and subregion, 2010

Region/subregion	Information availability		Area of primary forest		Regional distribution
	Number of countries	% of total forest area	1 000 ha	%	%
Eastern and Southern Africa	23	100.0	6 430	2.4	0.5
Northern Africa	8	100.0	13 990	17.8	1.0
Western and Central Africa	23	46.9	27 527	17.9	2.0
Total Africa	**54**	**74.2**	**47 947**	**9.6**	**3.5**
East Asia	5	100.0	25 268	9.9	1.9
South and Southeast Asia	17	100.0	81 235	27.6	6.0
Western and Central Asia	23	96.9	3 201	7.6	0.2
Total Asia	**45**	**99.8**	**109 705**	**18.6**	**8.1**
Europe excl. Russian Federation	42	97.7	5 438	2.8	0.4
Total Europe	**43**	**99.6**	**261 920**	**26.2**	**19.3**
Caribbean	16	70.4	205	4.2	n.s.
Central America	7	100.0	4 482	23.0	0.3
North America	5	100.0	275 035	40.5	20.2
Total North and Central America	**28**	**99.7**	**279 722**	**39.8**	**20.6**
Total Oceania	**17**	**99.7**	**35 493**	**18.6**	**2.6**
Total South America	**13**	**94.6**	**624 077**	**76.3**	**45.9**
World	**200**	**94.3**	**1 358 864**	**35.7**	**100.0**

the current area of forests in national parks and other protected areas as a proxy value or provided an expert estimate of the percentage of natural forests that could be considered primary according to the FRA 2010 definition.

There is great variation in the distribution of primary forests. At the regional level, the largest expanse is found in South America (624 million hectares), followed by North and Central America, and Europe (almost all in the Russian Federation) (see Table 3.1). Limited areas are reported by some countries of the Caribbean, Europe (excluding the Russian Federation) and the arid zones of Eastern and Southern Africa, Northern Africa and Western and Central Asia. A relatively high proportion of forests in Central Africa, North and Central America and the Russian Federation have been classified as primary.

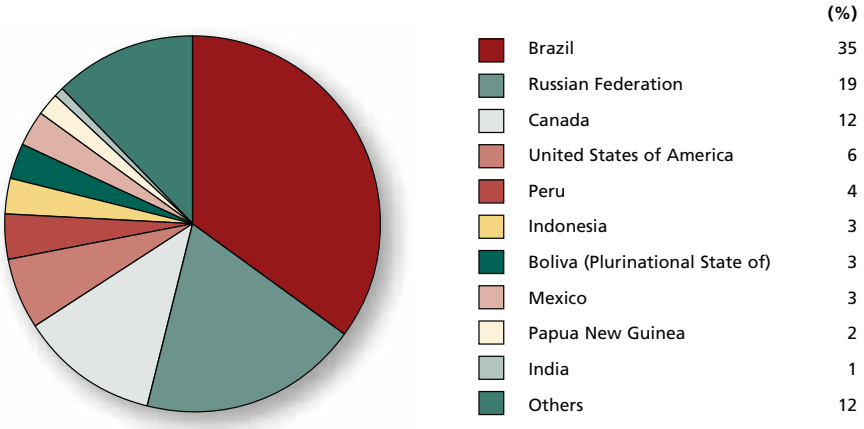
The ten countries with the largest areas of primary forest account for 88 percent of the total area of primary forest in the world (see Figure 3.1). However, as discussed above, information is missing from some of the large tropical countries, which might otherwise fall within the top ten countries. Primary forest makes up at least 50 percent of the total forest area in 19 countries, and seven countries have classified more than 75 percent of their forests as primary (Table 3.2 and Figure 3.2).

Of the 200 reporting countries and areas, 81 countries, mostly in Europe and the arid zones of Africa and Western Asia, as well as SIDS, reported that they have no primary forests left. In some cases, this may be due to a lack of data rather than a complete lack of primary forest, as for example in Finland.

Trends

A trend analysis was generated based on 198 countries accounting for 74 percent of the total forest area[14]. Of these, 184 countries provided data for all four years (1990, 2000, 2005 and 2010), including those reporting that they had no primary forest. Information was missing for eight countries for 1990 (Ecuador, Estonia, Guyana,

FIGURE 3.1
Ten countries with the largest area of primary forest, 2010

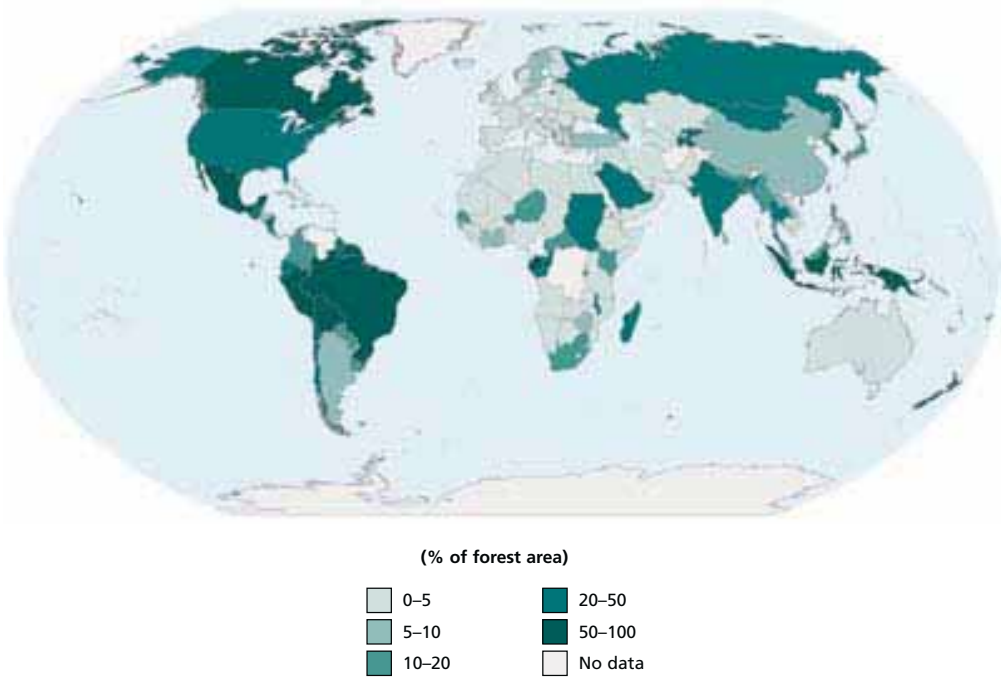


[14] Although information was provided for all four reporting years, the Russian Federation was excluded from this analysis because there was a large difference in the reported change rate (from +1.6 million hectares per year in the 1990s to -0.5 million hectares per year in the period 2000–2005). This is the result of a modification to the classification system introduced in 1995 rather than actual changes in primary forest area.

TABLE 3.2
Ten countries with the highest percentage of primary forest, 2010

Country/area	Primary forest as % of total forest	Area of forest (1 000 ha)	Area of primary forest (1 000 ha)
Singapore	100	2	2
French Guiana	95	8 082	7 690
Suriname	95	14 758	14 001
Brazil	92	519 522	476 573
Papua New Guinea	91	28 726	26 210
Peru	89	67 992	60 178
Micronesia (Federated States of)	75	64	48
Tajikistan	72	410	297
Brunei Darussalam	69	380	263
Gabon	65	22 000	14 334

FIGURE 3.2
Primary forest as a percentage of total forest area by country, 2010



Indonesia, Portugal, Republic of Korea, Saint Vincent and the Grenadines, and Samoa), and for seven additional countries (Australia, French Polynesia, Honduras, Jordan, Lebanon, New Zealand and Nicaragua) data were missing for both 1990 and 2000. Estimates were made for these countries using the same trend reported for 2000–2005 and 2005–2010 respectively. One country (Niue) only provided an estimate for 2010 and was excluded from the analysis. While filling these gaps gives a better idea of the trend over time, it probably underestimates the actual loss of primary forest, especially for the 1990s.

At the global level the area of primary forest decreased by around 4.7 million hectares per year in the 1990s, and by 4.2 million hectares per year between 2000 and 2010. This loss, which equates to 0.4 percent of the area of primary forest annually

over the ten-year period, is largely due to the reclassification of primary forest to other categories of forest because of selective logging and other human interventions during this period. However, information is still insufficient to determine precisely what proportion of the decrease in primary forest is due to deforestation and what is due to a reclassification to one of the two other categories: 'other naturally regenerated forests' and 'planted forests'.

South America accounted for the largest proportion of the net loss, followed by Africa and Asia. The rate of loss is stable or decreasing in all regions except Oceania, where it is increasing (primarily as a result of a higher reported loss from Papua New Guinea for the period 2005–2010); and in Europe, and North and Central America which registered a net gain (Table 3.3).[15]

At the subregional level, the loss of primary forests in Eastern and Southern Africa has increased slightly, primarily due to an increased rate of loss reported by Madagascar. In Northern Africa a significant reduction in the rate of loss is reported by Sudan, while in Western and Central Africa, a slight decrease in the rate of loss reported by Gabon and Nigeria influence the subregional totals.

Overall, the rate of loss of primary forest decreased in East Asia. The Republic of Korea reported the largest loss in this subregion. In contrast, Japan is increasing its net gain (see below) and Mongolia reported a decrease in its net loss. In South and Southeast Asia, Indonesia reported the largest loss of primary forest, but did not provide an estimate for 1990; the annual net loss for the 1990s was therefore assumed to be the same as in 2000–2005 for the purpose of Table 3.3 and is likely to be an underestimate. Over the period 2000–2010, Indonesia reported a significant reduction in the average annual area lost in the five years 2005–2010, compared with 2000–2005.

TABLE 3.3
Trends in area of primary forest by region and subregion, 1990–2010

Region/subregion	Information availability		Area of primary forest (1 000 ha)			Annual change (1 000 ha)		Annual change rate (%)	
	Number of countries	% of total forest area	1990	2000	2010	1990–2000	2000–2010	1990–2000	2000–2010
Eastern and Southern Africa	23	100.0	7 594	7 024	6 430	-57	-59	-0.78	-0.88
Northern Africa	8	100.0	15 276	14 098	13 990	-118	-11	-0.80	-0.08
Western and Central Africa	23	46.9	37 737	32 540	27 527	-520	-501	-1.47	-1.66
Total Africa	**54**	**74.2**	**60 607**	**53 662**	**47 947**	**-695**	**-572**	**-1.21**	**-1.12**
East Asia	5	100.0	28 179	26 456	25 268	-172	-119	-0.63	-0.46
South and Southeast Asia	17	100.0	87 062	83 587	81 235	-348	-235	-0.41	-0.29
Western and Central Asia	23	96.9	2 924	3 083	3 201	16	12	0.53	0.38
Total Asia	**45**	**99.8**	**118 166**	**113 127**	**109 705**	**-504**	**-342**	**-0.43**	**-0.31**
Total Europe	**42**	**19.1**	**5 183**	**5 360**	**5 438**	**18**	**8**	**0.34**	**0.14**
Caribbean	16	70.4	207	206	205	n.s.	n.s.	-0.07	-0.02
Central America	7	100.0	5 766	5 226	4 482	-54	-74	-0.98	-1.52
North America	5	100.0	274 920	273 795	275 035	-113	124	-0.04	0.05
Total North and Central America	**28**	**99.7**	**280 893**	**279 227**	**279 722**	**-167**	**50**	**-0.06**	**0.02**
Total Oceania	**16**	**99.7**	**41 416**	**39 191**	**35 493**	**-222**	**-370**	**-0.55**	**-0.99**
Total South America	**13**	**94.6**	**684 654**	**653 691**	**624 077**	**-3 096**	**-2 961**	**-0.46**	**-0.46**
World	**198**	**74.3**	**1 190 919**	**1 144 258**	**1 102 382**	**-4 666**	**-4 188**	**-0.40**	**-0.37**

[15] A gain in primary forest can occur when forest areas that were previously not classified as undisturbed are designated as areas in which no intervention should take place. With time, these areas evolve into forests that meet the definition of primary as used in the FRA process.

In Western and Central Asia, Turkey reported an increase in the area of primary forests – based on the area of forests in protected areas – while most other countries reported no primary forests, no data or no significant change.

In Europe (excluding the Russian Federation) an increase in the area of primary forest was reported by Bulgaria, Denmark, Lithuania, Poland and Slovenia, while Estonia and Latvia reported a slight decrease. All other countries reported no – or no significant – change.

In the Caribbean only the larger islands reported that they had areas of primary forest and there was no significant change in the total area. In Central America, Guatemala reported the largest area of primary forest and was the only country that reported a change in this area – with the loss in the last decade larger than in the 1990s. In North America, Mexico reported a decreasing rate of loss, while the United States of America reported an increasing rate of net gain of primary forest.

Australia did not report on the area of primary forest in 1990 and 2000, so for the purpose of Table 3.3, the change rate for the whole period was assumed to be the same as for 2005–2010. Papua New Guinea, which reported the largest area of primary forest in the region, also reported the largest loss of primary forest for the period, particularly in the last decade.

In South America, Brazil reported both the largest area and the largest loss; however, the rate of loss has decreased in the last decade from an average of 2.8 million hectares per year in the 1990s to 2.3 million hectares annually in 2005–2010. Peru and Bolivia also reported a significant loss of primary forests. This loss peaked in the period 2000–2005 in Peru and increased in Bolivia in the last decade compared with the 1990s.

The five countries reporting the largest decrease in primary forest over the last 20 years were Brazil, Gabon, Mexico, Papua New Guinea and Indonesia. A number of countries registered positive change rates in the area of primary forests, including several European countries, the United States of America and Japan. In most of these cases, countries have been setting aside natural forest areas in which no intervention should take place. With time, these areas evolve into forests in which there are no clearly visible indications of human activity and the ecological processes are not significantly disturbed, meeting the definition of primary forests used in FRA 2010. For example, Japan and some of the European countries classified all natural forests over a certain age or size, as well as all forests in inaccessible areas, as primary forests – in some cases only if no interventions had been conducted over a certain time period. The United States of America reported the largest net gain in primary forest of more than 200 000 ha per year, which was primarily the result of an increase in the area of forest in protected areas.

Conclusions

While globally more than one-third of total forest area is classified as primary forest, this area has decreased by more than 40 million hectares over the last ten years. Although there have been improvements in the availability of data on primary forests since the last global assessment, many countries still rely on proxies such as the area within national parks and other protected areas. Furthermore, information is still insufficient to determine what proportion of the decrease in primary forest is due to deforestation and what is due to a reclassification to one of the two other categories: 'other naturally regenerated forests' and 'planted forests'.

FOREST AREA DESIGNATED FOR CONSERVATION OF BIOLOGICAL DIVERSITY

Introduction

The designation and management of land for conservation is a key part of ongoing global efforts to conserve biological diversity. The amount of land on which the conservation of biological diversity is the primary function is therefore an important

indicator of progress, and monitoring of this variable provides valuable information for conservation practitioners.

The forest area designated primarily for conservation of biological diversity is not necessarily equivalent to the area of forest in protected areas because some forests in protected areas may be designated for reasons other than the conservation of biological diversity, such as the conservation of soil and water resources or cultural heritage. Conversely, forest areas may be designated for the conservation of biodiversity without forming part of a protected area network or system.

Status

Of the 233 countries and areas reporting for FRA 2010, 205 countries and areas, representing 99.9 percent of the total forest area, provided information on forest area designated primarily for the conservation of biological diversity. The availability of information has improved compared with the last assessment (FRA 2005), when only 172 countries reported on this variable. This is particularly noticeable in Western and Central Africa, where all 24 countries provided data (compared with only 15 for FRA 2005). The availability of information for FRA 2010 was low only in the Caribbean.

These data show that, globally, 463 million hectares of forest, or 11.5 percent of the total forest area of the reporting countries, are designated for the conservation of biological diversity as the primary function (see Table 3.4 and Figure 3.3).

The largest area of forest designated for conservation of biological diversity is found in South America (116 million hectares), followed by North America and Africa. Central America and South and Southeast Asia have the highest percentage of forests designated primarily for conservation, while Europe (including the Russian Federation), and Western and Central Asia have the lowest.

Trends

Data for all four reporting years (1990, 2000, 2005 and 2010) was provided by 186 countries, representing 86.9 percent of the total forest area (see Table 3.5).

TABLE 3.4
Area of forest designated for conservation of biodiversity by region and subregion, 2010

Region/subregion	Information availability		Area designated for conservation of biodiversity	
	Number of countries	% of total forest area	1 000 ha	% of forest area
Eastern and Southern Africa	23	100.0	27 821	10.4
Northern Africa	7	99.1	12 769	16.3
Western and Central Africa	24	100.0	51 939	15.8
Total Africa	**54**	**99.9**	**92 529**	**13.7**
East Asia	5	100.0	14 889	5.8
South and Southeast Asia	17	100.0	60 846	20.7
Western and Central Asia	24	100.0	2 778	6.4
Total Asia	**46**	**100.0**	**78 513**	**13.3**
Europe excl. Russian Federation	45	100.0	19 578	10.0
Total Europe	**46**	**100.0**	**37 150**	**3.7**
Caribbean	12	53.8	717	19.2
Central America	7	100.0	9 203	47.2
North America	5	100.0	99 049	14.6
Total North and Central America	**24**	**99.5**	**108 969**	**15.5**
Total Oceania	**21**	**99.8**	**30 640**	**16.0**
Total South America	**14**	**100.0**	**115 613**	**13.4**
World	**205**	**99.9**	**463 415**	**11.5**

FIGURE 3.3
Proportion of forest area designated for conservation of biodiversity by country, 2010

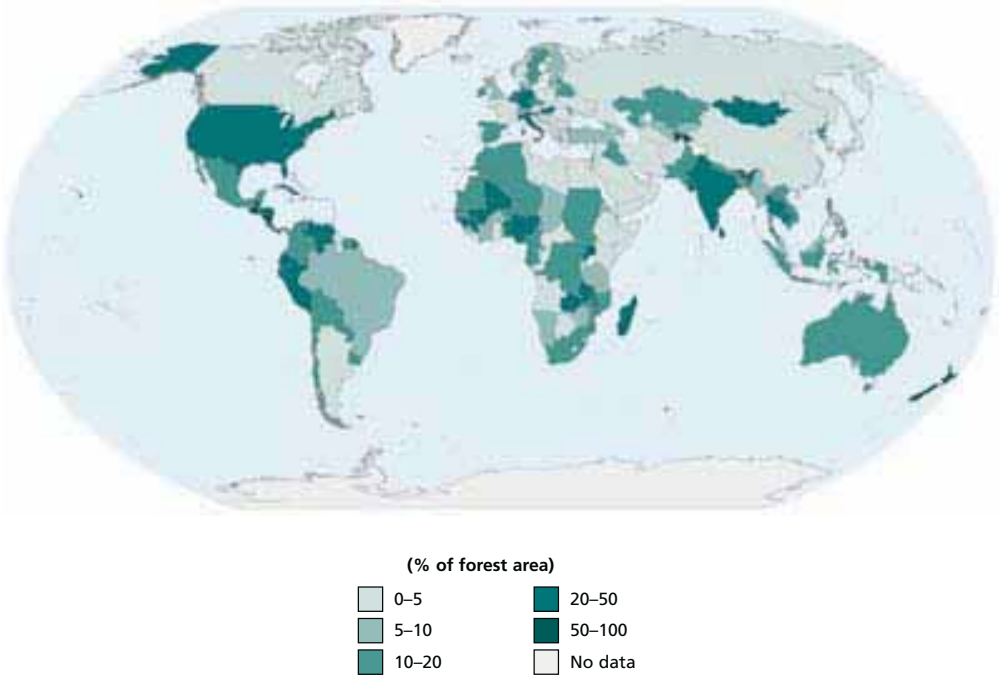
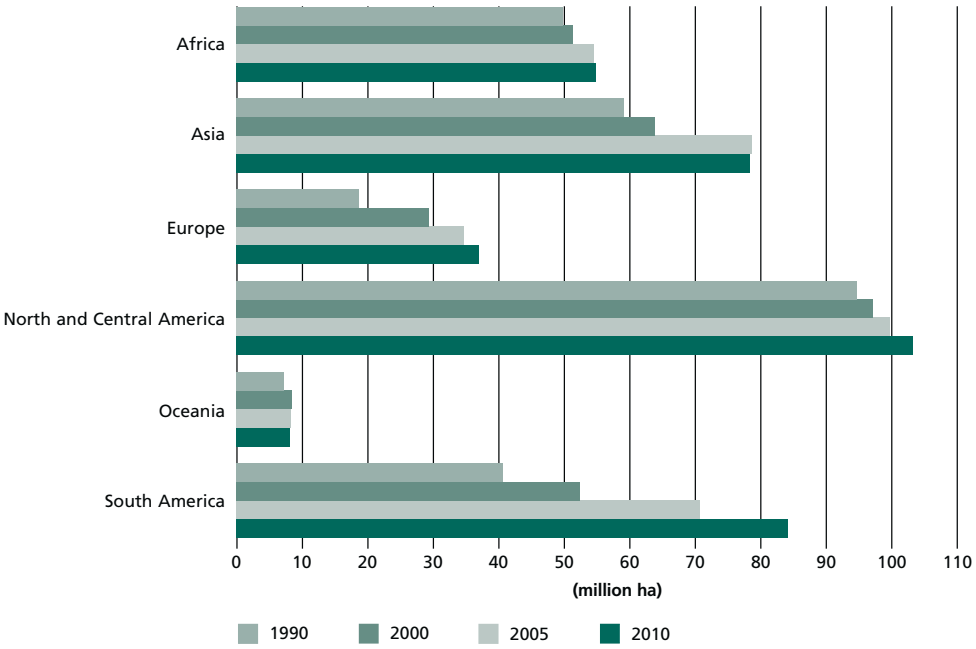


TABLE 3.5
Trends in area of forest designated for conservation of biodiversity by region and subregion, 1990–2010

Region/subregion	Information availability		Area of forest designated for conservation of biodiversity (1 000 ha)				Annual change (1 000 ha)		Annual change rate (%)	
	Number of countries	% of total forest area	1990	2000	2005	2010	1990–2000	2000–2010	1990–2000	2000–2010
Eastern and Southern Africa	21	80.9	14 467	15 539	17 176	17 064	107	153	0.72	0.94
Northern Africa	7	99.1	13 325	12 597	12 677	12 769	-73	17	-0.56	0.14
Western and Central Africa	22	52.5	22 135	23 215	24 791	25 039	108	182	0.48	0.76
Total Africa	**50**	**69.2**	**49 927**	**51 351**	**54 644**	**54 873**	**142**	**352**	**0.28**	**0.67**
East Asia	4	90.2	10 167	10 798	13 737	14 889	63	409	0.60	3.26
South and Southeast Asia	17	100.0	47 312	51 005	62 254	60 846	369	984	0.75	1.78
Western and Central Asia	23	99.7	1 710	2 095	2 775	2 775	39	68	2.05	2.85
Total Asia	**44**	**95.8**	**59 188**	**63 898**	**78 766**	**78 510**	**471**	**1 461**	**0.77**	**2.08**
Europe excl. Russian Federation	44	98.2	6 840	13 203	18 240	19 407	636	620	6.80	3.93
Total Europe	**45**	**99.7**	**18 655**	**29 393**	**34 728**	**36 979**	**1 074**	**759**	**4.65**	**2.32**
Caribbean	11	53.1	617	671	696	711	5	4	0.85	0.58
Central America	3	36.9	4 337	4 023	3 841	3 677	-31	-35	-0.75	-0.90
North America	5	100.0	89 811	92 619	95 316	99 049	281	643	0.31	0.67
Total North and Central America	**19**	**97.8**	**94 765**	**97 314**	**99 853**	**103 437**	**255**	**612**	**0.27**	**0.61**
Total Oceania	**18**	**21.6**	**7 196**	**8 412**	**8 334**	**8 234**	**122**	**-18**	**1.57**	**-0.21**
Total South America	**10**	**85.1**	**40 683**	**52 548**	**70 804**	**84 222**	**1 187**	**3 167**	**2.59**	**4.83**
World	**186**	**86.9**	**270 413**	**302 916**	**347 129**	**366 255**	**3 250**	**6 334**	**1.14**	**1.92**

FIGURE 3.4
Trends in area of forest designated for conservation of biodiversity by region, 1990–2010



The area of forest designated for the conservation of biological diversity has increased by more than 95 million hectares, or 30 percent, since 1990, of which the largest part was designated between 2000 and 2005. This trend is apparent in all regions and subregions except Northern Africa and Central America. The highest rates of increase are seen in South America (mainly due to recent conservation measures in Brazil) and Europe.

The period 2005–2010 shows a contrasting trend in some subregions however, with a decrease in South and Southeast Asia (mainly in Myanmar) and Eastern and Southern Africa, possibly correlated to the loss of forest area in these subregions. Figure 3.4 illustrates the evolution of the area of forest designated primarily for the conservation of biological diversity between 1990 and 2010 in different regions.

Conclusions

The area of forest where conservation of biological diversity is designated as the primary function has increased by more than 95 million hectares since 1990, of which the largest part (46 percent) was designated between 2000 and 2005. These forests now account for 12 percent of the total forest area or more than 460 million hectares.

AREA OF FOREST IN PROTECTED AREAS

Introduction

The legal designation of areas as national parks, wildlife reserves or other protected area categories has a long tradition and forests were included in some of the first of these. The World Database on Protected Areas (http://www.wdpa.org/Default.aspx) contains information on all nationally designated and internationally recognized protected areas. According to the latest information (WDPA, 2010), an estimated 12.9 percent of the global terrestrial area (excluding Antarctica) is located in protected areas.

As part of FRA 2010, countries were asked to provide information on the area of forest contained in protected areas systems. This is not an easy task where spatially explicit information is missing or outdated since not all protected areas are fully forested. However, most of the large, forest-rich countries did provide this information for all four reporting years. Where expert estimates or assumptions were necessary, these are clearly described in the individual country reports.

Status

Data on the area of forest in protected areas were provided by 135 countries, representing 91 percent of the total forest area. Information availability was relatively low in Western and Central Asia, the Caribbean, Central America and South America. The total area of forest in protected areas is 460 million hectares, representing 12.5 percent of the total forest area in reporting countries (Table 3.6 and Figure 3.5). Asia recorded the highest area of forest in protected areas (126 million hectares), followed by South America and Africa. Central America and South and Southeast Asia have the highest percentage of their forest area in protected areas, while Europe reported the lowest proportion of the forest area as protected area (4 percent). However, when excluding the vast forests of the Russian Federation, the percentage increases to 12.3 – similar to the world average.

A comparison of the percentage of forest in protected areas reported in FRA 2000 with the percentage of forest designated primarily for the conservation of biological diversity in FRA 2005, showed no significant difference. This observation led to the hypothesis that the similarity between the total figures for the two variables observed in FRA 2010 (460 million hectares in protected areas and 463 million hectares designated for conservation of biological diversity) would seem to indicate that countries were using the area of forest in protected areas as a proxy for the area of forest designated primarily for conservation of biological diversity.

TABLE 3.6
Area of forest in protected areas by region and subregion, 2010

Region/subregion	Information availability		Area of forest in protected areas	
	Number of countries	% of total forest area	1 000 ha	% of forest area
Eastern and Southern Africa	18	87.1	27 492	11.8
Northern Africa	5	98.5	13 986	18.0
Western and Central Africa	20	94.1	41 707	13.5
Total Africa	**43**	**91.8**	**83 185**	**13.4**
East Asia	4	97.6	43 752	17.6
South and Southeast Asia	11	88.5	80 303	30.8
Western and Central Asia	11	46.7	1 447	7.1
Total Asia	**26**	**89.3**	**125 502**	**23.7**
Europe excl. Russian Federation	35	93.4	22 475	12.3
Total Europe	**36**	**98.7**	**40 047**	**4.0**
Caribbean	9	50.4	779	22.3
Central America	4	60.7	6 501	54.9
North America	4	100.0	63 572	9.4
Total North and Central America	**17**	**98.4**	**70 852**	**10.2**
Total Oceania	**7**	**99.1**	**30 640**	**16.2**
Total South America	**6**	**74.6**	**109 806**	**17.0**
World	**135**	**91.0**	**460 032**	**12.5**

However, detailed comparison of the data showed that this was not systematically the case (see Tables 3.4 and 3.6). In some regions the reported area of forest in protected areas is slightly lower than the area of forest designated primarily for the conservation of biological diversity. In other regions, such as Asia (and in particular China, Indonesia, Malaysia and Thailand), the area of forest in protected areas is much higher than the area of forest designated for the conservation of biological diversity. This is an encouraging indication that some countries – and possibly a growing number – could make the distinction between the two variables. This would enhance the accuracy with which efforts to conserve biological diversity could be assessed.

Trends

A total of 109 countries (representing 78 percent of the total forest area) provided the full sequence of data on the area of forests in protected areas over time (see Table 3.7).

FIGURE 3.5
Percentage of forest area in protected areas by region, 2010

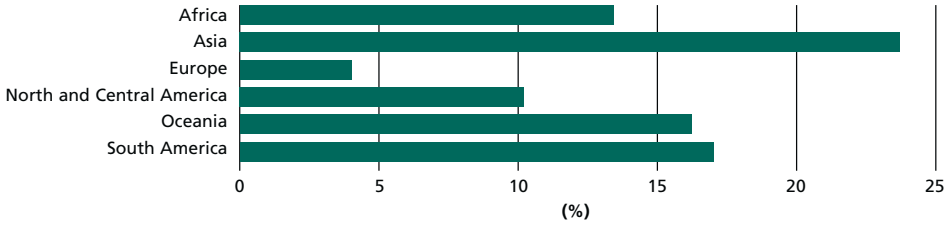


TABLE 3.7
Trends in area of forest in protected areas by region and subregion, 1990–2010

Region/subregion	Information availability		Area of forest in protected areas (1 000 ha)				Annual change (1 000 ha)		Annual change rate (%)	
	Number of countries	% of total forest area	1990	2000	2005	2010	1990–2000	2000–2010	1990–2000	2000–2010
Eastern and Southern Africa	17	86.6	24 786	25 863	27 524	27 437	108	157	0.43	0.59
Northern Africa	4	9.8	306	320	443	640	1	32	0.45	7.18
Western and Central Africa	18	47.0	20 330	21 748	22 206	25 401	142	365	0.68	1.56
Total Africa	**39**	**58.4**	**45 421**	**47 931**	**50 173**	**53 478**	**251**	**555**	**0.54**	**1.10**
East Asia	3	87.7	11 847	23 463	29 320	30 603	1 162	714	7.07	2.69
South and Southeast Asia	11	88.5	71 584	72 637	83 620	80 303	105	767	0.15	1.01
Western and Central Asia	8	38.0	306	559	799	781	25	22	6.23	3.39
Total Asia	**22**	**84.5**	**83 737**	**96 660**	**113 739**	**111 687**	**1 292**	**1 503**	**1.45**	**1.46**
Europe excl. Russian Federation	26	79.2	7 475	12 212	14 808	16 386	474	417	5.03	2.98
Total Europe	**27**	**95.9**	**19 289**	**28 402**	**31 296**	**33 959**	**911**	**556**	**3.94**	**1.80**
Caribbean	8	49.7	477	537	636	777	6	24	1.19	3.76
Central America	2	18.1	2 217	2 214	2 165	2 148	n.s.	-7	-0.01	-0.30
North America	4	100.0	47 356	50 135	56 338	63 572	278	1 344	0.57	2.40
Total North and Central America	**14**	**97.2**	**50 050**	**52 886**	**59 139**	**66 497**	**284**	**1 361**	**0.55**	**2.32**
Total Oceania	**4**	**16.7**	**617**	**617**	**617**	**405**	**0**	**-21**	**0.00**	**-4.12**
Total South America	**3**	**65.4**	**67 368**	**70 384**	**83 190**	**94 693**	**302**	**2 431**	**0.44**	**3.01**
World	**109**	**77.9**	**266 482**	**296 879**	**338 155**	**360 718**	**3 040**	**6 384**	**1.09**	**1.97**

This area increased steadily between 1990 and 2010, by more than 94 million hectares. While this is a general trend in all regions, poor availability of data for the full sequence does not permit a detailed assessment in those subregions showing a negative trend.

Conclusions

National parks, game reserves, wilderness areas and other legally established protected areas cover approximately 13 percent of the world's forest area and more than 10 percent of the total forest area in most countries and regions. The primary function of these forests may be the conservation of biological diversity, the protection of soil and water resources or the conservation of cultural heritage. The area of forest within protected area systems has increased by 94 million hectares since 1990. Two-thirds of this increase has been since 2000.

TREE SPECIES COMPOSITION

Introduction

Information on growing stock composition can be used as a proxy indicator of forest tree species richness and relative abundance. The percentage of growing stock represented by a given number of tree species is expected to be inversely correlated to tree species richness (and the number of tree species present in the area). Countries were requested to list the ten most common species in terms of growing stock and document their contribution to total growing stock for 1990, 2000 and 2005. Information was also obtained on the area of planted forests primarily composed of introduced species. The analysis of this data is found in Chapter 5.

To supplement this information, efforts are currently underway to solicit further details on the state of the world's forest genetic resources (see Box 3.1).

Status and trends

Information on the species represented in growing stock remains poor. For FRA 2010 only 79 countries (together representing 61 percent of the total forest area) provided data on the ten most common species (2005 data). The subregions with the highest response rates were East Asia, Europe, North America, Northern Africa and South and Southeast Asia (Table 3.8).

While the growing stock of the ten most common species represents more than 90 percent of the total growing stock in many countries in the temperate and boreal zone, it represents less than 20 percent of the total growing stock in tropical countries with high species diversity, such as the reporting countries from Western and Central Africa.

Data comparability is still an issue as indicated by the range of figures for each subregion (Table 3.8 and Figure 3.6). Some countries only have data on growing stock of commercial species with a merchantable diameter (e.g. Equatorial Guinea), others have data only for part of the country (e.g. Malaysia and United Republic of Tanzania) or have grouped some species (e.g. Guatemala and Poland). In addition, there is wide natural spread within some subregions – particularly when composed of both large, species-rich countries and small island states (e.g. Eastern and Southern Africa).

Comparison of the 1990 and 2005 data did not show significant changes in the relative ranking of the tree species, or in the share of growing stock occupied by the ten main species.

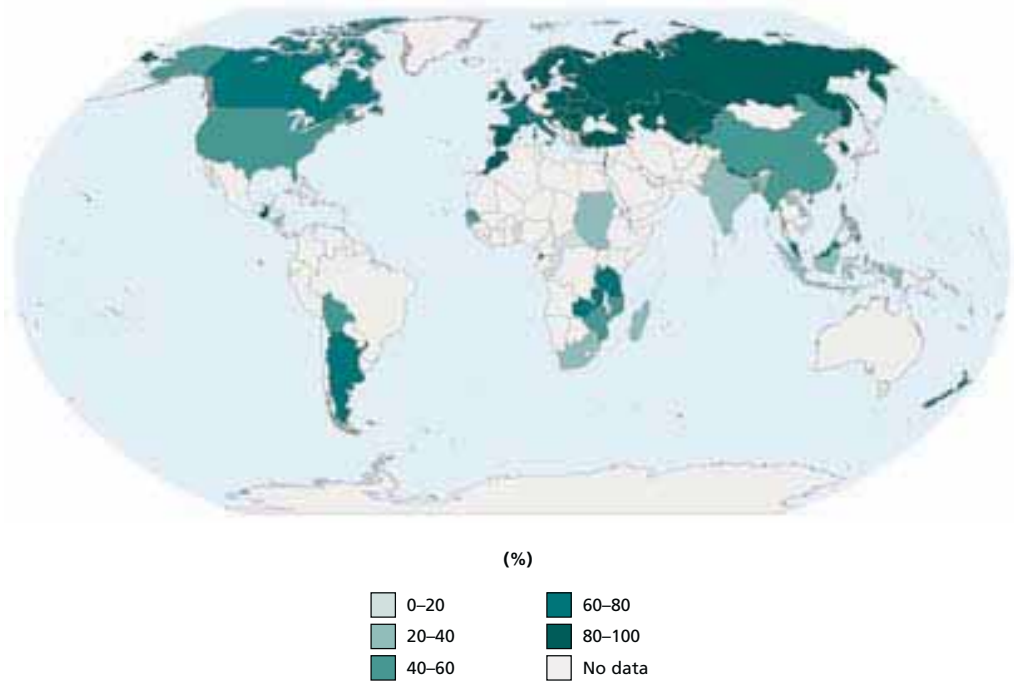
Conclusion

The analysis indicates that data on growing stock composition might provide reliable proxy indicators for tree species richness and relative abundance at a given time. This observation should be confirmed as comparable data become available from a larger number of countries.

TABLE 3.8
Growing stock of the ten most common species as a percentage of total growing stock by region and subregion, 2005

Region/subregion	Information availability		Growing stock of 10 most common species		
	Number of countries	% of total forest area	million m³	% of total growing stock	
				Weighted average	Range
Eastern and Southern Africa	7	59.7	3 363	37	21–100
Northern Africa	2	95.3	476	41	31–90
Western and Central Africa	6	18.6	1661	18	10–89
Total Africa	**15**	**43.8**	**5 500**	**28**	**10–100**
East Asia	2	82.4	8 183	58	57–86
South and Southeast Asia	10	88.4	10 837	39	18–74
Western and Central Asia	9	51.3	2 354	99	82–100
Total Asia	**21**	**83.2**	**21 374**	**48**	**18–100**
Europe excl. Russian Federation	27	84.4	21 291	92	61–100
Total Europe	**28**	**97.0**	**101 021**	**98**	**61–100**
Caribbean	3	11.3	25	58	50–80
Central America	2	35.7	655	57	21–85
North America	2	90.3	42 116	55	43–70
Total North and Central America	**7**	**88.0**	**42 795**	**55**	**21–85**
Total Oceania	**6**	**4.3**	**2 172**	**62**	**45–98**
Total South America	**2**	**10.1**	**4 046**	**55**	**49–65**
World	**79**	**61.0**	**176 908**	**69**	**10–100**

FIGURE 3.6
Growing stock of the ten most common species as a percentage of total growing stock by country, 2005



Chapter 4

Forest health and vitality

OVERVIEW

Forests are subject to a variety of disturbances that are themselves strongly influenced by climate. Disturbances such as fire, drought, landslides, species invasions, insect and disease outbreaks, and climatic events such as hurricanes, windstorms and ice storms influence the composition, structure and functions of forests (Dale *et al.*, 2001). Climate change is expected to affect forests' susceptibility to disturbances, as well as the frequency, intensity, duration and timing of such disturbances. For example, increased fuel loads, longer fire seasons and the occurrence of more extreme weather conditions as a consequence of a changing climate are expected to result in increased forest fire activity (Mortsch, 2006).

A changing climate will also alter the disturbance dynamics of native forest insect pests and pathogens, as well as facilitating the establishment and spread of introduced pest species. Such changes in disturbance dynamics, in addition to the direct impacts of climate change on trees and forest ecosystems, can have devastating effects and can increase forests' susceptibility to other disturbances. For example, a major storm in January 2005 – and again in 2007 – caused severe windthrow in southern Sweden, especially in middle-aged and old spruce stands resulting in increased populations of insects, notably the European spruce bark beetle, *Ips typographus.* Severe storms were also experienced in several other countries in Europe including Slovakia, where the storm of 2004/2005 affected 12 000 hectares of forest in the Tatra National Park, resulting in a severe bark beetle outbreak. Such interactions make the prediction of future impacts of climate change on forest disturbances more difficult.

All of these impacts on trees and forests will inevitably have widespread effects on the forest sector. Changes in the structure and functioning of natural ecosystems and planted forests (due to changes in temperatures and rainfall regimes) and extreme events and disasters (such as the Indian Ocean Tsunami in 2004 and storms and blizzards in China in 2008) have had adverse impacts on the productive function of forest ecosystems, which in turn affect local economies.

Pests, both native and introduced, pose one of the greatest threats to forests. Risk analysis, forecasting of future pest outbreaks and the design and implementation of cost-effective protection strategies all depend on the availability of comprehensive data at various levels. The development of phytosanitary measures to minimize transboundary movement of pests must be based on knowledge of the geographical distribution and biology of each pest – hence the need for national, regional and global data.

Continuous monitoring of forest ecosystems is an expensive process, which makes it problematic for developing countries and those with economies in transition. Even some industrialized countries do not sufficiently consider risks of pest outbreaks in their management plans. National data collection on disturbances affecting forests should provide a basis for improved planning and decision-making and will increase awareness of the severe problems related to forest insect pests and diseases worldwide, which are often overshadowed in the media by the occurrence of fire.

While some forest ecosystems depend on fire for their regeneration, some sensitive forest ecosystems can be devastated by fire, which can also cause a loss of property and human life. However, many countries do not have a reliable reporting system for

wildfires. National and global monitoring must be improved if countries are to adopt integrated approaches to fire management in an ecologically and socially acceptable way.

Data collected for FRA 2010 on forest health and vitality focused on the following, largely quantifiable categories, for which many countries record incidence and extent:

- area of forest significantly affected by insects;
- area of forest significantly affected by diseases;
- area burned (separated into areas of forest, other wooded land and other land);
- number of wildfires (separated into those affecting forests, other wooded lands and other land);
- proportion of wildfires and planned fires;
- area of forest significantly affected by other biotic factors (such as wildlife browsing, grazing and physical damage by animals);
- area of forest significantly affected by abiotic factors (such as air pollution, wind, snow, ice, floods, landslides, tropical storms, drought and tsunami);
- area of forest significantly affected by invasive species (woody species only).

Countries were also requested to list and rank up to ten major outbreaks of insects and diseases that have occurred since 1990.

The categories listed above are not exclusive; hence an area of land with two or more types of disturbance that affect the health and vitality of the forest is included under each type of disturbance. The total area affected by disturbances is, therefore, not necessarily the sum of the individual disturbances as these may overlap.

Countries were asked to provide data averaged over five years, so that large fluctuations in a single year did not significantly skew the figures. Data are thus presented for 1990 (an average of the period 1988–1992), 2000 (average of 1998–2002) and 2005 (average of 2003–2007).

To supplement the data obtained in the last assessment (FRA 2005), when only a small percentage of countries reported, a global review of forest pests and diseases was conducted (FAO, 2009a). Where appropriate, this study is referred to in this chapter in order to supplement the sometimes weak information obtained through the country reports. Similarly, a thematic study on forest fires was prepared as follow-up to FRA 2005 (FAO, 2007g).

KEY FINDINGS

Insect pests and diseases, natural disasters and invasive species are causing severe damage in some countries

Outbreaks of forest insect pests damage nearly 35 million hectares of forest annually, primarily in the temperate and boreal zones. The mountain pine beetle, *Dendroctonus ponderosae*, native to North America, has devastated more than 11 million hectares of forest in Canada and the western United States of America since the late 1990s and is spreading well beyond its normal range of occurrence in an unprecedented outbreak exacerbated by higher winter temperatures. Diseases, severe storms, blizzards and earthquakes have also damaged large areas of forest since 2000. Woody invasive species are of particular concern in SIDS, where they threaten the habitat of endemic species. Information availability and quality continue to be poor for most of these disturbances.

Forest fires are severely underreported at the global level

On average, 1 percent of all forests were reported to be significantly affected each year by forest fires. However, the area of forest affected by fires was severely underreported, with information missing from many countries, especially in Africa. Less than 10 percent of all forest fires are reported as prescribed burning; the rest are classified as wildfires.

KEY CONCLUSIONS

The overall conclusion drawn from the data supplied for FRA 2010 is that annually each type of disturbance (fire, insects, diseases, and other biotic and abiotic disturbances) usually affects less than one or two percent of the forest area, although in individual countries the affected area can be much higher. The assessment also clearly highlights the lack of timely and reliable data.

Intergovernmental efforts to gather, analyse and widely disseminate reliable country-based information on forest health factors must be further strengthened in order to provide a solid basis for decision-making and enhanced field level action. This information can provide the foundation for reliable risk analyses and the implementation of effective forest protection measures.

INSECTS AND DISEASES

Introduction

For the purposes of this report insects and diseases are discussed together as they are often co-dependent. While insects and diseases are integral components of forests and often fulfil important functions, sporadic outbreaks can have adverse effects on tree growth and survival, yield and quality of wood and non-wood forest products, wildlife habitat and the recreational, scenic and cultural value of forests.

In recent decades, two major factors have combined to increase the pest threat to forests:

- the volume, speed and variety of global trade have increased the opportunities for pests to move internationally;
- climate change appears to be increasing the likelihood of pest establishment and the severity of impacts of both native and introduced pests (see Box 4.1).

Threats to the world's forests require concerted international action. The development and implementation of phytosanitary measures is key to preventing the global movement of pests and their establishment in new areas. These measures have been developed through the International Plant Protection Convention (IPPC) and are delivered through International Standards for Phytosanitary Measures (ISPMs).

Despite the significant adverse impacts of forest pests, and indications that outbreaks are on the increase in some regions, they are still not sufficiently taken into consideration in the planning of forest management and conservation programmes. There has been no systematic attempt to gather and analyse comprehensive information on the type, scale and impact of such outbreaks at the global level.

Insect and disease problems are often either cyclical or chronic and they require long-term investment in data collection. A chronic disturbance by insects and diseases may be caused by a complex of species rather than a single entity. The complex can vary not only with the species involved, but also because of the impact of each individual species. Thus defining the beginning and end of a disturbance event can be a challenge.

Further complications arise when recording data on insect life cycles that overlap or are significantly longer than one year, or when cyclical disturbance events caused by pests last more than a year. For example, gypsy moth (*Lymantria dispar*) outbreaks of several generations can occur every seven to ten years. Capturing data on such long-term cyclical events is difficult, particularly when the length of the cycles is variable. The information supplied by countries for insect pests has been reported as annual averages over five years to help compensate for this. However, five-year reporting periods do not adequately reflect the status of long cyclical outbreaks.

Moreover, due to the longer duration of some disturbance events, it is difficult to accurately assess the area affected annually. Some countries appear to have reported the cumulative area affected in a given year, rather than the additional area of forest affected within that year. Thus the figures for the different types of disturbances are not always directly comparable.

BOX 4.1
Climate change and forest pests

Climate change – in particular increased temperatures and levels of atmospheric carbon dioxide, as well as changes in precipitation and the frequency and severity of extreme climatic events – is having notable impacts on the world's forests and the forest sector. Climate change is predicted to increase the likelihood of pest establishment in new locations and also to increase the severity of impacts of both native and introduced pests. This is likely to arise from two interrelated effects on the interactions between pests and host trees:

- Pests are likely to encounter more suitable climatic conditions for their establishment and successful development, i.e. they will survive extremes of temperature, such as winter cold or high summer temperatures, and be able to complete a full life cycle. This applies particularly to pests at the edges of the areas of climate suitability where, in the past, aspects such as low winter temperatures or lack of synchrony between pest emergence and host tree development prevented successful breeding. There is evidence that the natural ranges of pests are changing, extending the areas of forest at risk of outbreaks. Pests also tend to establish in new areas without the natural enemies that normally keep them in check.
- Potential host tree species may become more susceptible to pest development because of climate induced 'stress' caused by increased drought, extended growing seasons and generally increased vulnerability caused by extreme climatic events (e.g. flooding, extreme temperatures and violent storms).

Combined with increased climate suitability, both the opportunity to encounter trees in new locations arising from increased trade, and the capacity to establish because of a wider availability of tree hosts have substantially increased the incidences of new pest incursions globally. In addition to these increased risk factors, the fact that introduced pests often establish without the normal range of natural enemies that tend to keep them at endemic levels may influence the severity of impacts from new pests.

The quality of the data on forests significantly affected by insect pests and diseases is poor, in part because of the lack of clarity in interpreting what constitutes a 'disturbance'. Insect and disease outbreaks in developing countries are primarily surveyed and reported for planted forests, and corresponding surveys of forest decline and dieback are rare in these countries. Serious outbreak situations may be recorded, but details of causative agents and the quantifiable impact on forest resources are rarely noted. In some instances, there may be a reluctance to record severe outbreaks because management jobs or even trade in forest products can be put at risk.

For some regions, more data exist but were not readily accessible through FRA 2010 because of a lack of information exchange among sectors, individuals and government agencies, or a lack of awareness of their existence. For example, data are missing from the Democratic People's Republic of Korea, which has had an ongoing outbreak of the pine moth (*Dendrolimus spectabilis*) since 1998, affecting more than 100 000 hectares of native *Pinus densiflora*. Countries in Eastern and Southern Africa have a complexity of insect and disease problems affecting their forests (FAO, 2009a and http://www.fao.org/forestry/fisna/en/) but this is not reflected in the FRA 2010 data. Similar situations exist in many countries, where other sources indicate disturbances that are not recorded in the country reports.

For FRA 2010 more detailed information was requested than in FRA 2005 and this resulted in considerable feedback from reporting countries about problems of

data collection. Most of these comments are applicable to all regions and should be considered for FRA 2015. A number of issues were highlighted.

- Disturbances caused by insect pests, especially bark beetles and wood borers, may only be reported according to the amount of affected wood removed, rather than by the area infested: for example, in 2005, Poland reported the removal of more than 3.2 million cubic metres of infested wood. Reports may only include the actual area reforested after salvage. In addition, a forested area may be defoliated by more than one insect and this often results in an overlap of reported figures. Areas reported as defoliated may include patches that differ in the degree of defoliation severity. Areas of tree mortality caused by an insect attacking one or more species may include other tree species, which subsequently die from exposure because the stand is opened. Some areas of defoliation may be missed in the surveys.
- For diseases, it can be difficult to convert figures from the total area showing damage to an area newly affected in a year. The area damaged may be underestimated as it can be difficult to assess disease in standing trees. Diseases are very difficult to report especially in mixed planted forests; there may be spatial distribution of the disease and, especially for dispersed agents, it may be more appropriate to report the percentage of the population of the species that is infested instead of the area affected.
- For both insects and diseases, new reporting methods may have been adopted by countries between the reporting periods, making trend analysis difficult. Small areas which do not meet the definition of forest in the FRA process may be infected (by disease) or infested (by insect) and would therefore not be reported as significant. Data may be aggregated and difficult to separate or may only be available for state owned, not private, forests.
- Further complexities may be caused by diebacks and declines, as a multiplicity of biotic (insects, diseases, mammals) and abiotic factors contribute to the disturbance.

Status

Globally, information on forest insect pests and diseases is relatively sparse and the data collection methods are highly variable. Several countries could not disaggregate figures for insects and diseases. Many of the small island countries and dependent territories have not provided information for these two variables, as was the situation for FRA 2005. Reporting from Africa was also scant.

However, more countries reported for FRA 2010 than for FRA 2005. For insect damage this increased from 66 to 94 countries, which represent 53 percent of the world's forest area. East Asia, Europe and North and Central America provided reports that represented more than 90 percent of the total forest areas for these regions.

The reports indicate that close to 40 million hectares of forest per year were adversely affected by insects and diseases in 2005. The annual area of forest affected by insects alone was more than 34 million hectares, representing 1.6 percent of the forest area of the 94 reporting countries.

Tables 4.1 and 4.2 present a summary of results for the 2005 reporting period, while Figures 4.1 and 4.2 present the results by country. Table 4.1 shows that Northern Africa, North America, East Asia and Europe excluding the Russian Federation reported the highest percentage of forest area significantly affected by insect pests, while countries with tropical moist forests generally reported a very low proportion of their forests affected. This is most likely due to the high diversity of tree species in tropical moist forests.

Canada reported the highest area of insect disturbance for a single country of 17.3 million hectares. This included major outbreaks of two indigenous species in

TABLE 4.1
Average area of forest annually affected by insects by region and subregion, 2005

Region/subregion	Information availability		Area of forest affected by insects	
	Number of countries	% of total forest area	1 000 ha	% of forest area
Eastern and Southern Africa	4	4.7	n.s.	n.s.
Northern Africa	4	9.6	261	3.4
Western and Central Africa	3	4.9	2	n.s.
Total Africa	**11**	**5.3**	**263**	**0.7**
East Asia	4	97.4	4 078	1.7
South and Southeast Asia	5	26.6	985	1.2
Western and Central Asia	13	43.7	308	1.6
Total Asia	**22**	**57.2**	**5 372**	**1.6**
Europe excl. Russian Federation	36	79.4	3 458	2.3
Total Europe	**37**	**96.0**	**5 126**	**0.5**
Caribbean	7	50.0	2	0.1
Central America	3	48.0	7	0.1
North America	4	100.0	22 951	3.4
Total North and Central America	**14**	**98.0**	**22 961**	**3.3**
Total Oceania	**4**	**5.0**	**40**	**0.4**
Total South America	**6**	**15.0**	**726**	**0.5**
World	**94**	**53.0**	**34 487**	**1.6**

TABLE 4.2
Average area of forest annually affected by diseases by region and subregion, 2005

Region/subregion	Information availability		Area of forest affected by diseases	
	Number of countries	% of total forest area	1 000 ha	% of forest area
Eastern and Southern Africa	4	4.7	n.s.	n.s.
Northern Africa	2	1.3	n.s.	n.s.
Western and Central Africa	4	5.3	4	n.s.
Total Africa	**10**	**4.6**	**4**	**n.s.**
East Asia	3	92.7	349	0.2
South and Southeast Asia	4	26.2	n.s.	n.s.
Western and Central Asia	12	42.6	41	0.2
Total Asia	**19**	**54.9**	**390**	**0.1**
Europe excl. Russian Federation	33	71.8	1 786	1.3
Total Europe	**34**	**94.6**	**2 918**	**0.3**
Caribbean	6	48.9	n.s.	n.s.
Central America	1	18.9	n.s.	n.s.
North America	2	9.7	19	n.s.
Total North and Central America	**9**	**10.3**	**19**	**n.s.**
Total Oceania	**4**	**4.7**	**320**	**3.5**
Total South America	**4**	**10.5**	**113**	**0.1**
World	**80**	**36.3**	**3 764**	**0.3**

2006: the mountain pine beetle (*Dendroctonus ponderosae*), which damaged 9.2 million hectares of forest, and the forest tent caterpillar (*Malacosoma disstria*), which affected 5 million hectares.

Information on diseases is still sporadic and countries reporting on this variable represent only 36 percent of the total forest area. However, more countries reported on diseases for FRA 2010 than for FRA 2005, increasing from 57 countries to 80.

FIGURE 4.1
Average area of forest annually affected by insects by country, 2005

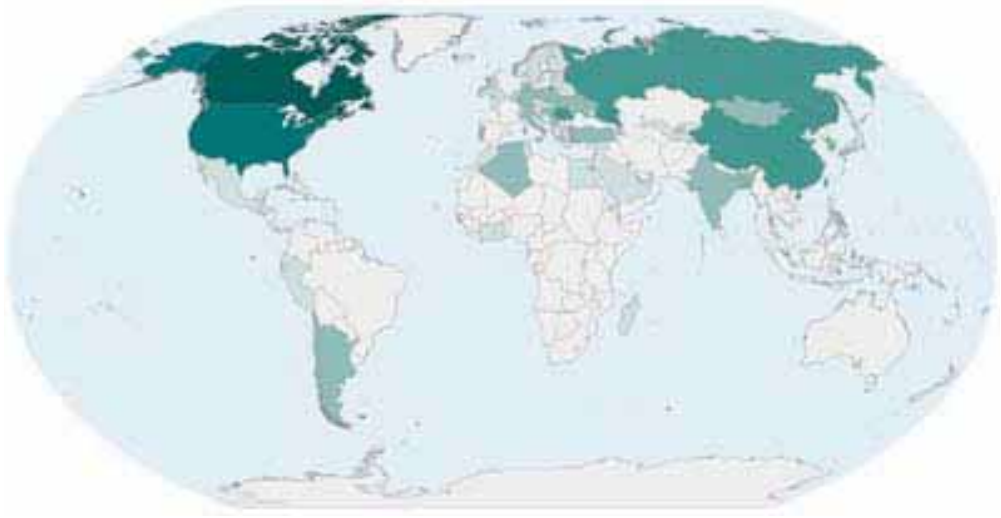


FIGURE 4.2
Average area of forest annually affected by diseases by country, 2005

Disease affected 3.8 million hectares (5-year average) representing 0.3 percent of the total forest area of the 80 reporting countries. For the 2005 reporting period, East Asia and Europe provided data for over 90 percent of the forest areas within the region. However, for many countries information on diseases was missing, not available or was recorded as zero, particularly by countries in Africa, Central and North America and the Caribbean.

No data were reported on diseases for the United States of America in this reporting period, compared with 17.4 million hectares reported for FRA 2005. This was due to substantial changes in the forest disturbances indicator design that included altering the presentation to specify the proportion of forest damage caused by non-native insects and pathogens (Heinz Center, 2008). Consequently disease data was not recorded for this reporting period.

Europe (excluding the Russian Federation) reported a high incidence of disease affecting 1.3 percent of the forest area. The Russian Federation reported disease affecting 1.1 million hectares of forest, equivalent to less than 0.2 percent of its forest area, but the causative agents were not specified.

In Oceania, New Zealand only reported diseases in planted forests; no diseases were reported in indigenous forests. In Asia the highest incidence of disease was reported for China and this represented 0.2 percent of China's total forest area; no details on causative agents were provided.

Trends

For insect infestations, of the 233 countries and areas included in FRA 2010, 69 countries, representing 49 percent of the total forest area, provided data for all periods i.e. 1990, 2000 and 2005. A further 25 countries provided data for the 2005 reporting period only.

For diseases, 58 countries provided data for all three reporting periods. A further 22 countries provided data for the 2005 reporting period only. Relatively few countries reported quantitative data, and it is therefore not possible to undertake a detailed trend analysis for the three reporting periods. As a result only regional results are presented here.

Generally speaking, no significant trends were noted and any changes within these reporting periods may be attributable to altered methods of assessment for the three periods rather than actual trends. However, there appears to be a decreasing trend in the area affected by forest insect pests for the period 1990 to 2005 in North and South America. An increase was noted in the area of forest affected by disease since 1990 in Asia (particularly East Asia) and in Europe (including the Russian Federation) (see Tables 4.3 and 4.4). It should be noted, however, that this information is indicative only. Although there are three data points in time, disease data are missing for a number of the larger forest countries such as Australia, Canada and the United States of America.

Countries were also invited to list and rank up to ten major outbreaks of insects and diseases that have occurred since 1990, recording the name of the causative agent, the tree species affected, year of outbreak, area affected (if recorded) and the outbreak cycle (see Tables 4.5 and 4.6).

Similarities were noted in insect and disease distributions among some of the regions. However, the distribution is indicative only, as many countries did not provide this information. Table 4.5 therefore includes mainly European countries. More details about many of these pest species and their distributions are available in FAO (2009a).

Conclusions

Two main conclusions can be drawn.

While usually affecting less than 2 percent of the global forest area, insect pests and diseases are causing severe damage in some countries, primarily in the temperate

TABLE 4.3
Trends in area of forest annually affected by insects by region and subregion, 1990–2005

Region/subregion	Information availability		Area of forest affected by insects					
	Number of countries	% of total forest area	1990		2000		2005	
			1 000 ha	% of forest area	1 000 ha	% of forest area	1 000 ha	% of forest area
Eastern and Southern Africa	4	4.7	0	0	n.s.	n.s.	n.s.	n.s.
Northern Africa	3	9.5	272	3.7	178	2.4	260	3.5
Western and Central Africa	2	3.2	0	0	0	0	0	0
Total Africa	**9**	**4.5**	**272**	**0.9**	**178**	**0.6**	**260**	**0.8**
East Asia	4	97.4	829	0.4	3 761	1.7	4 078	1.7
South and Southeast Asia	3	3.5	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Western and Central Asia	10	41.9	420	2.5	549	3.2	300	1.7
Total Asia	**17**	**45.2**	**1 250**	**0.6**	**4 309**	**1.7**	**4 378**	**1.7**
Europe excl. Russian Federation	26	61.3	2 673	2.4	2 292	2.0	2 747	2.3
Total Europe	**27**	**92.6**	**4 390**	**0.5**	**7 245**	**0.8**	**4 415**	**0.5**
Caribbean	5	8.8	1	0.1	0	0	0	0
Central America	1	1.5	1	0.2	1	0.2	1	0.4
North America	3	100.0	33 666	5.0	21 206	3.1	22 951	3.4
Total North and Central America	**9**	**96.2**	**33 667**	**5.0**	**21 206**	**3.1**	**22 953**	**3.4**
Total Oceania	**3**	**4.2**	**60**	**0.8**	**50**	**0.6**	**40**	**0.5**
Total South America	**4**	**10.5**	**868**	**0.9**	**533**	**0.6**	**318**	**0.3**
World	**69**	**49.3**	**40 507**	**2.1**	**33 521**	**1.7**	**32 363**	**1.6**

TABLE 4.4
Trends in area of forest annually affected by diseases by region, 1990–2005

Region	Information availability		Area of forest affected by diseases					
	Number of countries	% of total forest area	1990		2000		2005	
			1 000 ha	% of forest area	1 000 ha	% of forest area	1 000 ha	% of forest area
Africa	7	3.6	0	0	n.s.	n.s.	n.s.	n.s.
Asia	15	42.7	155	0.1	460	0.2	389	0.2
Europe	24	91.4	838	0.1	1 700	0.2	2 069	0.2
North and Central America	6	9.4	11	0	2	n.s.	19	n.s.
Oceania	3	4.2	265	3.4	240	2.9	320	3.9
South America	3	2.7	13	0.1	810	3.4	110	0.5
World	**58**	**31.7**	**1 282**	**0.1**	**3 212**	**0.3**	**2 907**	**0.2**

and boreal zones. As a recent example, the mountain pine beetle, *Dendroctonus ponderoseae*, native to North America has devastated more than 11 million hectares in Canada and the western United States of America since the late 1990s and is spreading well beyond its normal range of occurrence in an unprecedented outbreak exacerbated by milder winter temperatures.

Information availability on the area of forest significantly affected by insect pests and disease continues to be poor and data collection methods are highly variable. Methods need to be devised to obtain and analyse data on diseases in particular.

The problems with data reporting in the country reports should be taken into consideration and methods need to be devised to obtain and analyse data on diseases in particular.

TABLE 4.5
Ten most prevalent insect pests reported

Pest	Number of reports	Countries
Lymantria dispar, gypsy moth (European and Asian strains)	27	Algeria, Armenia, Belarus, Bulgaria, Croatia, Georgia, Germany, Hungary, Israel, Kyrgyzstan, Latvia, Lithuania, Lebanon, Maldives, Mongolia, Morocco, Republic of Moldova, Russian Federation, Serbia, Slovakia, Switzerland, The Former Yugoslav Republic of Macedonia, Tunisia, Turkey, Ukraine, United States of America, Uzbekistan
Ips typographus, European spruce bark beetle	19	Austria, Croatia, Czech Republic, Denmark, France, Georgia, Germany, Hungary, Latvia, Lithuania, Netherlands, Poland, Romania, Russian Federation, Serbia, Slovakia, Sweden, Switzerland, Turkey
Tortrix viridana, European oak leaf roller	10	Croatia, Czech Republic, Germany, Netherlands, Poland, Republic of Moldova, Romania, The Former Yugoslav Republic of Macedonia, Tunisia, Ukraine
Thaumetopoea pityocampa, pine processionary caterpillar	9	Albania, Algeria, Bulgaria, Croatia, Morocco, Syrian Arab Republic, The Former Yugoslav Republic of Macedonia, Tunisia, Turkey
Neodiprion sertifer, European pine sawfly	7	Belarus, Georgia, Latvia, Norway, The Former Yugoslav Republic of Macedonia, Turkey, Ukraine
Panolis flammea, pine beauty moth	7	Belarus, Germany, Latvia, Lithuania, Poland, Ukraine, United Kingdom
Pityogenes chalcographus, six-toothed spruce bark beetle	7	Austria, Croatia, Czech Republic, Germany, Serbia, Slovakia, Switzerland
Bupalus piniarius, pine looper moth	6	Estonia, Germany, Latvia, Poland, Ukraine, United Kingdom
Dendrolimus pini, pine lappet moth	6	Belarus, Georgia, Germany, Lithuania, Poland, Ukraine
Lymantria monacha, nun moth	6	Belarus, Czech Republic, Germany, Latvia, Lithuania, Poland

TABLE 4.6
Most prevalent pathogens reported

Pathogen	Number of reports	Countries
Armillaria spp., Armillaria root disease	10	Austria, Bhutan, Brazil, Croatia, Germany, Malawi, Mauritius, New Zealand, Peru, Slovakia
Cryphonectria parasitica, chestnut blight	6	Albania, Croatia, Georgia, Germany, The Former Yugoslav Republic of Macedonia, Turkey
Heterobasidion spp., annosum root rot	6	Austria, Belarus, Finland, Germany, Russian Federation, The Former Yugoslav Republic of Macedonia
Melampsora larici-populina, poplar rust	4	Belgium, France, Iceland, Uzbekistan
Mycosphaerella pini, red band needle blight	4	Belgium, Croatia, France, New Zealand
Sphaeropsis sapinea, diplodia tip blight	4	Austria, Croatia, France, Germany
Chalara fraxinea, ash dieback	3	France, Germany, Norway
Gremmeniella sp.	2	Finland, Sweden
Melampsora allii-populina, poplar rust	2	Albania, France

FOREST FIRES

Introduction

Fire is a major disturbance factor that has both beneficial and detrimental effects. Some forest ecosystems are adapted to fire and need it to retain their vigour and reproductive capacity. However fires often get out of control and destroy forest vegetation and biomass, which in turn results in considerable soil erosion by wind and water. Fires affect not only forests and their functions and services, but also other assets, human

lives and livelihoods. The damage extends to landscapes, and results in haze and deposited pollutants, as well as the release of greenhouse gases. Both uncontrolled expansion of agricultural land onto forested land and the increased use of forests for recreational purposes and tourism increase the risk of forest fires.

In relation to the loss of human lives recent examples include the forest fires in Victoria, Australia in 2009, which caused 173 fatalities (Teague, McClead and Pascoe, 2009), while fires in Greece in 2007 fires resulted in 80 dead (69 civilians, 9 seasonal fire fighters and 2 pilots) (Joint Research Centre, 2008). Many wilderness–urban interface fires (e.g. in Australia, Italy and the United States of America) have clearly shown how wildfires affect and threaten residential areas.

Status

Information on forest fires continues to be poor. Based on the data from 78 responding countries, representing 63 percent of the global forest area, an average of just under 60 million hectares of land (forests, other wooded land and other land) burned per year during the period 2003–2007 in these countries. The largest areas burnt were reported by Cameroon, Mali, Botswana, Chad, Namibia, United States of America, Ghana, Canada, Mongolia and Senegal.

Some 13 countries were able to provide information on the total area burnt, but did not specify the forest area burnt. Many of these were relatively small countries in Africa (6), Asia (2) and Central America (1), but the list also included such forest-rich countries as Brazil, Bolivarian Republic of Venezuela and Papua New Guinea.

Just over half the countries and areas included in FRA 2010 (118 out of 233) provided information on the area of forest burnt in the period 2003–2007. Based on the data from these 118 countries, which represent 65 percent of the global forest area, an average of 19.8 million hectares of forests were affected by fire annually. This area represents less than one percent of the total forest area in these countries (see Table 4.7). The highest percentages of forest area affected by fire were reported by Chad, Senegal, Ghana, Botswana and Portugal, while the largest areas of forest affected by fire were reported

TABLE 4.7
Average area of forest annually affected by fire by region and subregion, 2005

Region/subregion	Information availability		Area of forest affected by fire	
	Number of countries	% of total forest area	1 000 ha	% of forest area
Eastern and Southern Africa	8	29.3	452	0.6
Northern Africa	5	10.0	17	0.2
Western and Central Africa	8	19.7	7 849	11.9
Total Africa	**21**	**22.4**	**8 318**	**5.4**
East Asia	5	100.0	549	0.2
South and Southeast Asia	8	83.3	1 859	0.7
Western and Central Asia	16	51.7	50	0.2
Total Asia	**29**	**87.9**	**2 457**	**0.5**
Europe excl. Russian Federation	41	96.6	270	0.1
Total Europe	**42**	**99.4**	**1 262**	**0.1**
Caribbean	7	74.1	15	0.3
Central America	4	72.6	107	0.7
North America	4	100.0	3 437	0.5
Total North and Central America	**15**	**98.9**	**3 558**	**0.5**
Total Oceania	**6**	**82.5**	**3 903**	**2.4**
Total South America	**5**	**14.0**	**333**	**0.3**
World	**118**	**65.2**	**19 831**	**0.7**

by Chad, Australia, United States of America, India and Canada, which all reported an average of more than 1 million hectares of forest burnt annually (Figure 4.3).

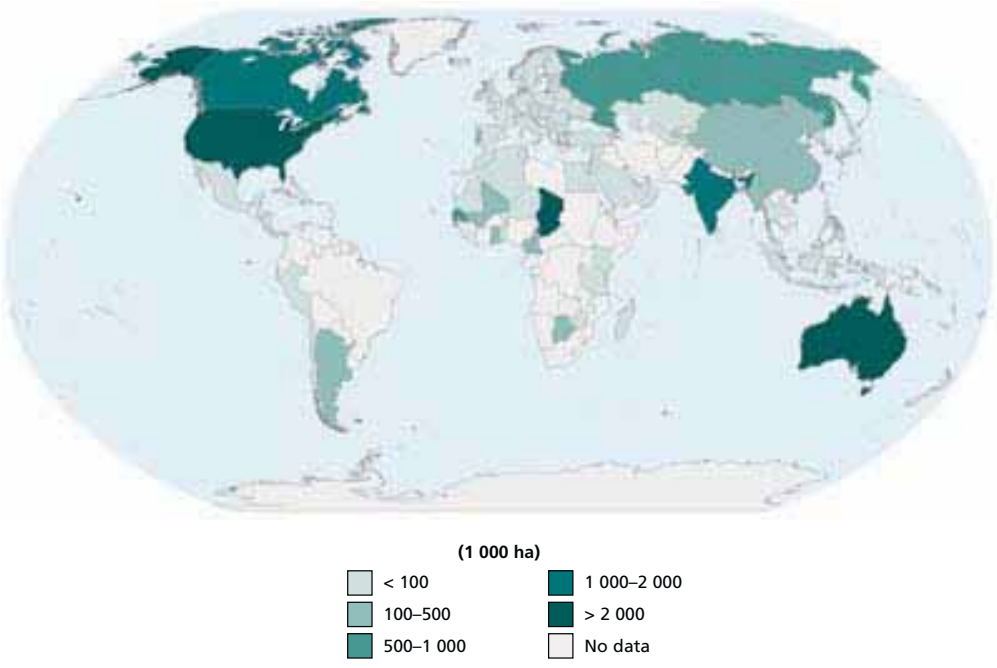
An additional 17.9 million hectares of other wooded land were significantly affected by fire each year during the period 2003–2007 in 105 countries. Although the reporting countries represent less than half the global forest area, there is a clear indication that a large proportion of fires are significantly affecting other wooded lands. This is especially the case in Africa, where large areas of other wooded land affected by fire were reported by Cameroon, Chad, Botswana, Ghana, Madagascar and Senegal. This phenomenon may be explained by the widespread use of fire as a land-use management tool.

Countries were also asked to report on the number of fires. According to information from 64 countries, representing 60 percent of the global forest area, an average of 487 000 vegetation fires occurred per year during the period 2003–2007 in forests, other wooded land and other land. Mozambique, the United States of America, Madagascar, Poland, Portugal, the Russian Federation, Spain, Argentina and Hungary top the list – all with an average of over 10 000 vegetation fires per year.

In terms of the number of forest fires, 81 countries, representing 50 percent of the global forest area, reported an average of 156 000 forest fires per year during the period 2003–2007 (i.e. an average of around 1 900 forest fires per country per year). However, as would be expected, there was great variation between countries. The largest numbers of forest fires were reported by the United States of America, the Russian Federation, India, Poland and China, which all reported an average of more than 10 000 forest fires per year. The small proportion of global forest area represented by the reporting countries makes it difficult to estimate the global number of forest fires during this period.

Countries were asked to estimate how large a proportion of the area burnt was caused by wildfire as opposed to planned fires. Some 87 countries, accounting for 77 percent of the world's forests, provided this information for the period 2003–2007.

FIGURE 4.3
Average area of forest annually affected by fire by country, 2005



In these countries an estimated 94 percent of the total forest area affected by fire was due to wildfires and only 6 percent due to planned fires. Although these countries represent a high proportion of the global forest area, more information is needed to confirm this figure. In many cases the information seems to be based on expert estimates rather than on national registration systems.

Trends

A total of 96 countries, accounting for 59 percent of the total forest area in the world, provided information on the area of forest burnt for all three reporting periods (1990, 2000 and 2005). The total area burnt (forest, other wooded land and other land combined) for all three periods was reported by 52 countries, accounting for 58 percent of the forest area. Information on the area of other wooded land and other land burnt for all three periods was reported by 87 and 29 countries respectively, together accounting for 43 and 21 percent of the forest area.

Both the total area affected by fires and the forest area affected by fires are lower in recent years compared with the period around 1990. However, whether this can be interpreted as a consistent trend is debatable, given the lack of comprehensive information and the nature of fires, which are closely linked to climatic fluctuations such as the El Niño phenomenon in some countries and regions. It is an encouraging sign that countries such as Thailand and Indonesia have significantly reduced the area of forest burnt annually, although it is too early to tell the impact of fires in 2010 which is predicted to be another strong El Niño year.

Table 4.8 shows the subregional and regional figures for the three reporting periods for those countries that provided a complete data series.

The number of forest fires has decreased slightly over the years while the proportion of wildland fires has remained relatively constant for the reporting countries. Information was provided on the number of forest fires for all three reporting periods by only 61 countries (accounting for 45 percent of total forest area) and this variable may be considered less useful in future assessments. The proportion of the area burned

TABLE 4.8
Trends in area of forest annually affected by fire by region and subregion, 1990–2005

Region/subregion	Information availability		Area of forest affected by fire (1 000 ha)		
	Number of countries	% of total forest area	1990	2000	2005
Eastern and Southern Africa	6	25.0	88	50	53
Northern Africa	4	9.6	14	21	16
Western and Central Africa	4	9.2	12 141	8 462	7 157
Total Africa	**14**	**15.6**	**12 243**	**8 533**	**7 226**
East Asia	5	100.0	318	417	549
South and Southeast Asia	7	82.2	3 090	2 149	1 852
Western and Central Asia	13	48.7	19	79	47
Total Asia	**25**	**87.1**	**3 427**	**2 644**	**2 448**
Europe excl. Russian Federation	36	80.2	273	225	261
Total Europe	**37**	**96.2**	**896**	**1 387**	**1 252**
Caribbean	6	73.8	11	18	15
Central America	0	–	–	–	–
North America	4	100.0	2 781	3 112	3 437
Total North and Central America	**10**	**96.8**	**2 793**	**3 130**	**3 452**
Total Oceania	**5**	**4.2**	**0**	**0**	**0**
Total South America	**5**	**14.0**	**490**	**708**	**333**
World	**96**	**59.0**	**19 849**	**16 402**	**14 710**

that was caused by wildfire as opposed to planned fires was reported for all three periods by 73 countries (representing 56 percent of the total forest area) and showed no significant change over time.

Box 4.2 illustrates the type of analysis that can be undertaken for countries where information on forest fires is more readily available.

BOX 4.2

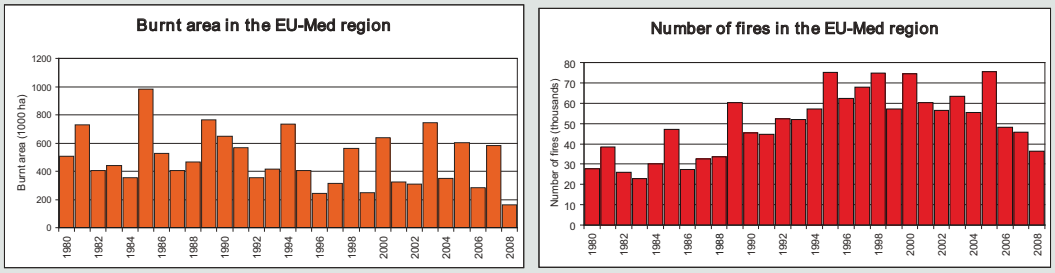
Trends in forest fires in Europe

Although forest fires are an integral part of forest dynamics in Europe, trends in fire frequency and fire impact have changed throughout the years. The data for this analysis were extracted from the European Fire Database in the European Forest Fire Information System (EFFIS). These data include single fire records provided by the individual European countries in the EFFIS network. Currently, data from 21 countries are available in this database, although the network is made up of 26 countries. The number of years for which data are available differs between countries, with the time series for the Mediterranean region being the longest.

Fire frequency is determined by the annual number of fires in a country. A derived measure of fire frequency is fire density, which is estimated as the number of fires by area (in this case 10 square km). Due to the fact that most of the fires in Europe take place in the Mediterranean region, fire figures are presented for the Mediterranean region, and separately for the rest of Europe. Figure 4.4 presents the number of fires and the total burnt area in the Mediterranean region in the last decades. The figure shows a slightly decreasing trend in the number of fires during recent years. However, the trend in the burnt areas is not obvious. Years with a large fire impact are next to years with minor fire effects.

FIGURE 4.4

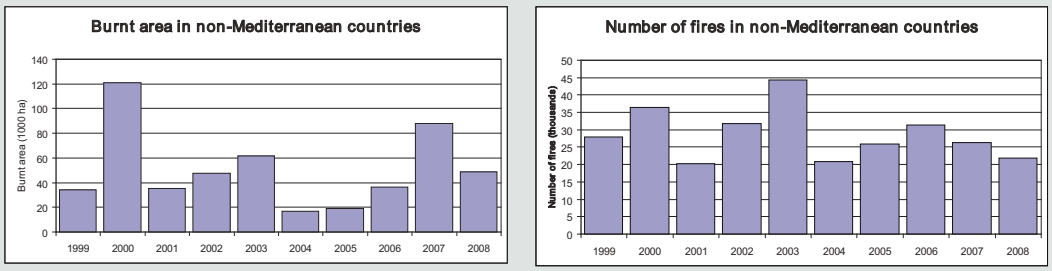
Number of fires and burnt area in the EU-Mediterranean region



The non-Mediterranean countries do not show clear trends in the number of fires or the total burnt area. The number of fires and the total burnt area in this part of Europe are presented in Figure 4.5.

FIGURE 4.5

Number of fires and total burnt area in the non-Mediterranean region



Fire frequency expressed as average forest fire density provides information on the spatial distribution of forest fires. Fire density in Europe and total burnt area by country and forest area (burnt fraction) in each country are shown in Figure 4.6.

FIGURE 4.6
Average forest fire density and average burned forest fraction in Europe, 1998–2007

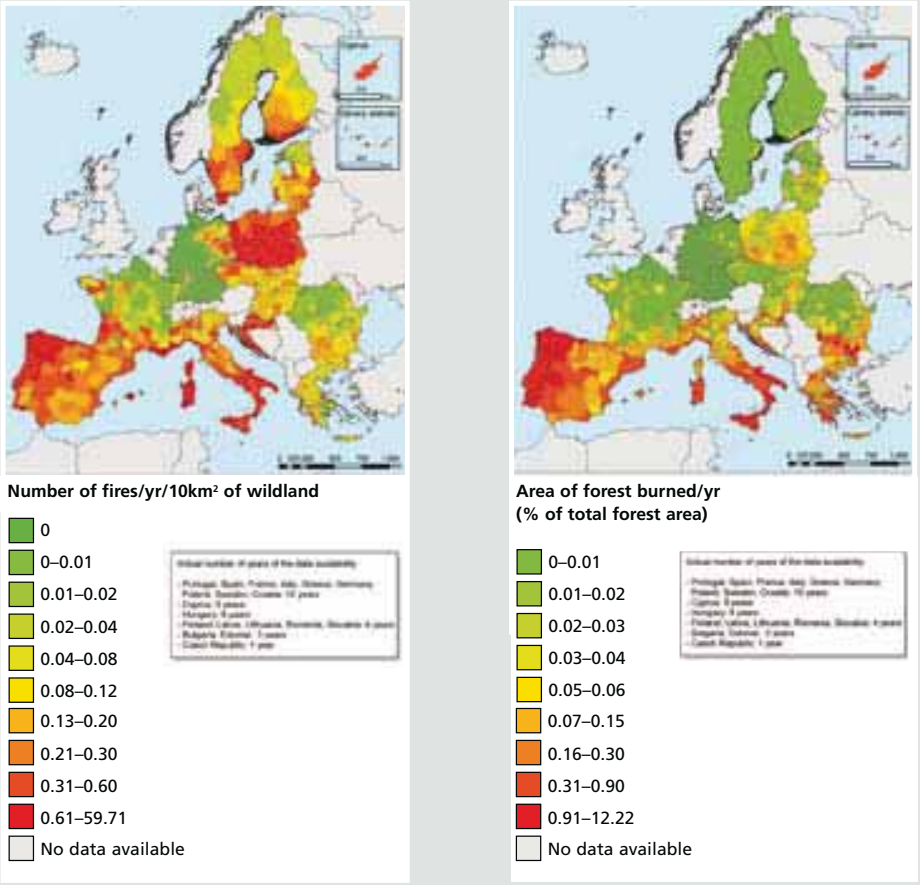


Figure 4.6 shows that fires are not confined to the Mediterranean region, although the largest impact in terms of burnt areas occurs in this region. Fire density in the northern and eastern regions of Europe can also be high; however, the extent of these fires is not large due to the weather conditions under which they occur. Analysis of the data in EFFIS showed a very close correlation between fire danger, which represents the weather conditions, and the total burnt area for the overall Mediterranean region.

Source: European Commission, 2009

Notes:
Mediterranean countries included in this study: Cyprus, France, Greece, Italy, Portugal and Spain.

Non-Mediterranean countries included in this study: Bulgaria, Croatia, Czech Republic, Estonia, Finland, Germany, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Sweden, Switzerland and Turkey.

Conclusions

On average, 1 percent of all forests were reported to be significantly affected each year by forest fires. However, the area of forest affected by fires was severely underreported, with information missing from many countries, especially in Africa. Less than 10 percent of all forest fires are reported as prescribed burning; the rest are classified as wildfires.

Data on the extent of forest affected by fires contribute to our understanding of fires, and thus to the development of appropriate risk management strategies. Even when data on fire frequency and areas burned are available, disaggregation of this data into different kinds of vegetation (forests, other wooded land and other land) is often lacking. Additional information is needed on the ecological dynamics of fire, direct and underlying causes, impacts and the desired long-term ecosystem condition (e.g. structure, species composition and health).

The use of remote sensing for forest fire monitoring should be encouraged, particularly for countries in Africa, which seems to be the continent most affected by wildfires. Yet reporting on the extent of fires and their impacts on forests and other wooded land is missing for many counties in this region.

OTHER DISTURBANCES

Introduction

For the purposes of the FRA 2010 report, other disturbances include a range of biotic and abiotic factors, as well as the spread of invasive (woody) species.

Disturbance by biotic factors includes damage by biotic agents other than insects or diseases, such as wildlife browsing, bark stripping, grazing or other physical damage by animals. In general, information on disturbances attributed to these factors is highly erratic and open to interpretation, with a broad range of causative agents. Problems reported include possums, camels, beavers, deer, rodents (particularly squirrels and rats), lagomorphs (hares and rabbits), plus mites and nematodes (especially the quarantine pest, the pine wood nematode, *Bursaphelenchus xylophilus*).

The impact of mammalian browsing (as noted with possums in the New Zealand country report for FRA 2010) can vary within plant populations, communities and ecosystems, and is influenced by a range of biotic and abiotic factors, which may predispose plant communities to browsing damage. Selective browsing on some species may have a gradual effect on forest composition, with some species disappearing from certain areas.

Abiotic disturbances, including climatic events such as storms, drought, wind, snow, ice and floods, have always influenced forest ecosystems and are considered important for maintaining biological diversity and facilitating forest regeneration. However, global climate change, primarily the result of human activities, is reportedly making forest ecosystems more prone to damage by altering the frequency, intensity and timing of fire events, hurricanes, storms, landslides, and insect and disease outbreaks. Climate-related shifts in the range of pest species, many of which are forest-dependent, can further exacerbate abiotic impacts on forest health.

In European forests where timber production is a major objective, heavy storms can create significant economic, ecological and social problems and together with fire are likely to be the most important, large-scale disturbance to stands of both natural and managed forests. Catastrophic storms tend to occur every five to ten years in Europe; however due to the effects of climate change, change in wind patterns or oceanic currents and general increased variability in meteorological events, the period between destructive storms could change in the coming years or decades. These storms are becoming of such concern that the Directorate-General for the Environment of the European Commission is preparing a study on destructive storms entitled *Destructive Storms in European Forests: Past and Forthcoming Impacts*.

To supplement the information in FRA 2010, and in acknowledgement of the increasing importance of abiotic influences on forest health, FAO will prepare a more detailed study in 2011.

Several disturbance factors such as illegal logging, encroachment, overharvesting and other unsustainable management practices were not included in the reporting for FRA 2010 because of a lack of quantitative information in most countries. However, some countries did report on disturbances caused by human interference. For instance, several countries commented on overharvesting through illegal cutting, encroachment and habitat degradation from excessive hunting and tourism as significant causes of disturbance to forest and other wooded land.

Status

Reporting of other biotic and abiotic disturbances was more detailed in FRA 2010 than in FRA 2005. However, in general, information on disturbances attributed to these factors was highly sporadic, with a broad range of causative agents. While some categories have broad relevance (e.g. storms and wind), other data have relevance to relatively isolated areas (e.g. specific animal species). Furthermore, there may only be occasional reporting after a major storm or other major weather event and most often the volume of wood that is damaged is reported (e.g. through salvage felling reports) but not the area affected. Thus few of the data are comparable and it has not been possible to carry out a separate analysis for each of the disturbances caused by biotic and abiotic influences.

For the 2005 reporting period 60 countries, accounting for only 13 percent of the total forest area, reported that biotic agents affected close to 30 million hectares of forest, and 60 countries (together representing 27 percent of the world's forest area) reported that abiotic factors affected 8 million hectares of forest. However, there appears to be a wide range of interpretations of the term 'significantly affected by' with some countries reporting on the total area in which one of the factors has been recorded, regardless of the severity of the impact, while others have applied a more strict definition of damage.

In Asia, India recorded some 25.5 million hectares of forests as being affected by grazing by domestic animals and 4.4 million hectares by abiotic disturbances. China reported approximately 0.75 million hectares of forests affected by rat damage. The UK noted that present mammal damage was likely to have been persistent for many years so the presence of new damage did not necessarily imply that the area was newly affected. There may also be overlaps between the areas recorded with mammal bark stripping and mammal browsing.

Since the last assessment (FRA 2005) there have been some major catastrophic events including the Indian Ocean tsunami in December 2004 (not fully reported in FRA 2005). The tsunami took over 200 000 lives and destroyed livelihoods and infrastructure all around the Indian Ocean. Among other damage, trees were snapped, uprooted and undermined by waves and strong currents associated with the tsunami. In addition to the physical damage, some trees – particularly planted trees – were affected by soil salination. Reports that intact coastal forest (including mangroves) provided protection against the tsunami prompted the affected countries to call for the establishment of coastal buffer zones or greenbelts (FAO, 2006c). For the FRA 2010 assessment, the Maldives reported considerable destruction of trees and forest vegetation caused by the tsunami, but neither Thailand nor Indonesia reported damage.

In Europe, Sweden recorded 1.8 million hectares affected by biotic factors and 1.2 million hectares affected by abiotic factors including a major storm in January 2005 which caused severe windthrow in the south of the country, especially affecting middle-aged and old spruce stands. The same storms that contributed to extensive windthrow in 2005 (and 2007) resulted in increased populations of some insects,

notably *Ips typographus.* The Russian Federation reported that abiotic factors affected 1.3 million hectares of forests and Italy reported snow, storm and drought affecting 0.5 million hectares of forest.

Storms and blizzards in January 2008 caused great damage to 18.6 million hectares of forest in eight provinces in China including Hunan; 1 781 state-owned farms and 1 200 nurseries were severely damaged, while 760 tonnes of tree seed and 10 billion seedlings were frozen (State Forestry Administration, 2008). In addition to a catastrophic loss of human life and destruction of towns and villages, the earthquake in Wenchaun, Sichuan Province, China in 2008 caused forest fragmentation and severely damaged ecosystems that support some of the last remaining giant panda (*Ailuropoda melanoleuca*) populations in the wild (Xu *et al.*, 2009). No reference to either of these extreme events was made in China's country report.

Disturbances in Africa were generally not quantified. The disturbance caused by cyclones remains irregular and thus unpredictable, particularly for small islands such as Mauritius. The severe drought of the 1970s and 1980s which affected the mangrove ecosystem in the Gambia was reported but again no quantitative data were available.

The impact of woody invasive species on forest health and vitality is causing increasing concern and 48 countries listed up to five invasive species each. Several species may be found in more than one country and in more than one region (see Table 4.9). Some countries included data on the area of forest affected. The United States of America recorded 34 million hectares of forest affected by five woody invasive species (including shrubs and vines). Sudan recorded 1.6 million hectares affected by *Prosopis chilensis*. In relative terms, small island states and territories such as French Polynesia, Réunion and Mayotte recorded the largest proportion of their forests affected by invasive woody species (from 35 to 65 percent of the total forest area).

It should be noted that methodologies for monitoring invasive species may not exist in some countries, may not be applicable, or may only be suitable for one genus (e.g. acacias in Portugal which are recorded through an individualized area evaluation in the national forest inventory). Herbaceous weeds may also be included and the area of invasiveness may include overlapping species.

TABLE 4.9
Most prevalent woody invasive species reported

Species	Number of reports	Countries
Acacia spp. including: *Acacia* sp. (3 reports) *A. mangium* (3) *A. dealbata* (2) *A. auriculiformis* (2) *A. cyanophylla* (1) *A. farnesiana* (1) *A. salicina* (1) *A. saligna* (1) *A. victoriae* (1)	10	Cook Islands, Cuba, Cyprus, Israel, Liberia, Portugal, Réunion, South Africa, Spain, Trinidad and Tobago
Ailanthus altissima	6	Bulgaria, Cyprus, Hungary, Italy, Spain, United States of America
Prosopis juliflora	6	Chad, Ethiopia, Mauritania, Niger, Saudi Arabia, Yemen
Acer negundo	5	Austria, France, Hungary, Poland, Spain
Lantana camara	5	Bhutan, New Caledonia, Réunion, Swaziland, South Africa
Leucaena leucocephala	5	Barbados, Bhutan, Jamaica, Liberia, New Caledonia
Prunus serotina	5	Belgium, France, Luxembourg, Netherlands, Poland
Robinia pseudoacacia	5	Croatia, Italy, Poland, Slovenia, Switzerland
Amorpha fruticosa	3	Bulgaria, Croatia, Hungary

Trends

Of the 233 countries and areas included in FRA 2010, 45 countries reported on the area of forest affected by biotic factors other than insects and diseases for all three reporting periods (i.e. 1990, 2000 and 2005), representing a mere 10 percent of the total forest area. A further 15 countries reported for the 2005 reporting period only. Data were provided by 45 countries on the area of forest affected by abiotic factors other than fire for all three reporting periods, together accounting for 24 percent of the total forest area. A further 15 countries provided data for the 2005 reporting period only.

At this point in time, there is insufficient quantitative information for a trend analysis.

Conclusions

Information on disturbances caused by biotic and abiotic factors other than insects, disease and fire was very sporadic and included a broad range of causative agents – some of them very localized – making an aggregation and comparison between countries and regions virtually impossible.

Major factors reported included storms, domestic animals and damage by wildlife including rats. The impact of woody invasive species on forest health and vitality is causing increasing concern – particularly in SIDS, where they threaten the habitat of endemic species.

An international agreement on what constitutes a disturbance and how best to obtain and analyse data would assist with future data collection and reporting.

Chapter 5

Productive functions of forest resources

OVERVIEW

Forests, other wooded land and trees outside forests provide a wide range of wood and non-wood forest products. The productive function of forest resources is a traditional thematic element and one of the main objectives of forest resources assessments. It indicates the economic and social utility of forest resources to national economies and forest-dependent local communities and reflects the wish to maintain an ample and valuable supply of primary forest products, while at the same time ensuring that production and harvesting are sustainable and do not compromise the management options of future generations for productive or other functions of forests.

Earlier assessments were focused on timber supply, but the concept of forest production has since widened to encompass all types of wood and non-wood forest products. As part of the FRA 2010 process, information was collected on the following variables related to the productive function of forest resources[16]:

- area of forest designated for production;
- area of planted forests;
- areas of afforestation and reforestation;
- removals of wood products;
- removals of non-wood forest products (NWFPs).

Many products are extracted from forests, ranging from wood for timber and fuelwood to food (berries, mushrooms, edible plants, bushmeat), fodder and other NWFPs. By quantity, industrial roundwood and woodfuel are the most important products; among NWFPs, food and fodder are the most significant.

KEY FINDINGS

Thirty percent of the world's forests are primarily used for production of wood and non-wood forest products

Close to 1.2 billion hectares of forest are managed primarily for the production of wood and non-wood forest products. An additional 949 million hectares (24 percent) are designated for multiple use – in most cases including the production of wood and non-wood forest products. The area designated primarily for productive functions has decreased by more than 50 million hectares since 1990, or 0.22 percent annually as forests have been designated for other purposes. The area designated for multiple use has increased by 10 million hectares in the same period.

The area of planted forest is increasing and now accounts for 7 percent of total forest area

Forests and trees are planted for many purposes and make up an estimated 7 percent of the total forest area, or 264 million hectares. Five countries (China, the United

[16] Not all planted forests are designated for productive functions, but since no information was solicited on the designated functions of planted forests, the information gathered on them and on afforestation and reforestation is presented in this chapter.

States of America, the Russian Federation, Japan and India) account for more than half (53 percent) of this area. Some arid zone countries and the Netherlands report that all their forests are planted. Between 2000 and 2010, the area of planted forest increased by about 5 million hectares per year. Most of this was established through afforestation (i.e. planting of areas not classified as forest) particularly in China.

The rate of establishment of planted forests has increased in the past 10 years compared with the 1990s in most regions except for Europe. Given the current trend, a further rise can be anticipated in the area of planted forest to 300 million hectares by 2020.

Three-quarters of all planted forests consist of native species

The remaining quarter comprises introduced species. In sub-Saharan Africa, Oceania and South America a number of countries with a significant area of planted forests report that they almost exclusively plant introduced species. In the temperate and boreal zones of Europe and North America and in arid zone countries introduced species are used to a minor extent.

More than 10 million hectares per year are afforested or reforested each year

In the 10-year period from 1998 to 2007, at the global level, altogether more than 10 million hectares per year were afforested and reforested, mostly with indigenous species. China accounts for a large proportion of this area. Introduced species are used, on average, at a rate of 29 percent in afforestation and 36 percent in reforestation.

Wood removals increased between 2000 and 2005, following a fall in the 1990s

At the global level, reported wood removals in 2005 amounted to 3.4 billion cubic metres annually, similar to the volume recorded for 1990 and equivalent to 0.7 percent of the total growing stock. Considering that informally and illegally removed wood, especially woodfuel, is not usually recorded, the actual amount of wood removals is undoubtedly higher. At the global level, woodfuel accounted for about half of the removed wood. Wood removals from other wooded land amounted to 299 million cubic metres or 9 percent of total wood removals in 2005. The proportions of industrial roundwood and woodfuel did not change significantly between 1990 and 2005.

Food is the largest category of NWFP removals globally

Other important categories include exudates, other plant products, wild honey andbeeswax, and ornamental plants. Asia, and in particular China, reported the largestvolume of NWFP removals, most of which are of plant origin (camellia, oil seeds, nuts andbamboo products). The sheer size of the removals reported by China dwarfs any othercountry's removals. Europe has the highest reported level of animal-based NWFPremovals.

KEY CONCLUSIONS

More than half of the world's forests are designated primarily for the production of wood and NWFPs or have productive functions as part of the management objective. In addition to meeting the demands for wood and a large range on NWFPs, these forests provide income and employment to millions of people worldwide.

The decrease in the area of forest designated primarily for productive functions reflects an increased reliance on planted forests and more intensively managed natural forests for wood production and a partial shift in designation from production to multiple use in line with increasing demands for other services provided by forests.

The area of planted forests is increasing rapidly and most of the long-term growth in wood supply is occurring in countries that have established planted forests during the

last few decades. In spite of data limitations it is evident that wood supply (particularly industrial roundwood) is shifting from natural forests to planted forests.

It is thus foreseen that planted forests will increasingly contribute to the supply of the world's wood, fibre, fuel and NWFPs (as well as protecting soil and water resources and fulfilling other purposes) and that this shift may reduce the pressure on natural forests. The impact of this development on timber markets should be considered by policy-makers, planners and forest managers and supported by outlook studies that evaluate the future contribution of planted forests to economic, environmental and social services.

Information on NWFPs continue to be poor and efforts should be made to improve data collection and analysis given their importance in support of local livelihoods and also their substantive contribution to the national economy in some countries.

Reporting on afforestation and reforestation was introduced for the first time in FRA 2010 in an attempt to obtain better information on forest change dynamics. Although a large number of countries were able to report on these variables, significant issues still need to be resolved before a complete balance sheet of gains and losses in forest area over time can be reported by all countries.

AREAS DESIGNATED FOR PRODUCTIVE FUNCTIONS

Introduction

Forest areas that have been designated for productive functions bear no legal, economic or technical restrictions on wood production and serve primarily for the production of various commodities, including roundwood (industrial roundwood and woodfuel) and NWFPs. They have been designated either by legal prescription or by decision of the landowner or manager. In these forests production is reported as the 'primary function', which is considered to be significantly more important than other functions.

Status

Based on information from the 205 countries and areas that reported on this variable – together accounting for 99.9 percent of the total forest area – at the global level, close to 1.2 billion hectares or 30 percent of the total forest area have production designated as the main function in 2010 (see Table 5.1 and Figure 5.1).

The regional results indicate some marked differences in the perception and designation of forest functions. Europe has the highest share of forest where production is the primary function (52 percent of its forest area), while North America and South America reported only 14 percent designated for production. North America reported most of its forest area as designated for multiple use, while South America showed a fairly equal distribution across the five main forest functions (production, protection, conservation, social services and multiple use). A number of countries with forest areas above 10 million hectares designated more than 70 percent of their forest area to multiple use (the Plurinational State of Bolivia, Botswana, Canada, Central African Republic, Ethiopia, Germany, Iran, Mexico and Zimbabwe). See Table 5 in Annex 3.

Trends

The analysis of trends in area of forest designated primarily for production is based on the countries that reported a complete time series for 1990, 2000, 2005 and 2010 (187 countries representing 90.6 percent of the global forest area). The results are shown in Table 5.2.

Globally since 1990, there has been a slightly decreasing trend in the area of forest with production as the primary function. The decline amounts to 2.5 million hectares per year (-0.22 percent annually) for the period from 1990 to 2010. Many regions and subregions follow this global trend, while Northern Africa, Western and Central Africa, Asia, Europe and the Caribbean show an irregular pattern.

TABLE 5.1
Area of forest designated for production by region and subregion, 2010

Region/subregion	Information availability		Area of forest designated for production	
	Number of countries	% of total forest area	1 000 ha	% of total forest area
Eastern and Southern Africa	23	100.0	73 077	27
Northern Africa	7	99.1	36 819	47
Western and Central Africa	24	100.0	95 141	29
Total Africa	**54**	**99.9**	**205 037**	**30**
East Asia	5	100.0	98 978	39
South and Southeast Asia	17	100.0	124 239	42
Western and Central Asia	24	100.0	9 537	22
Total Asia	**46**	**100.0**	**232 754**	**39**
Europe excl. Russian Federation	45	100.0	110 855	57
Total Europe	**46**	**100.0**	**526 646**	**52**
Caribbean	12	53.8	1 030	28
Central America	7	100.0	3 613	19
North America	5	100.0	97 138	14
Total North and Central America	**24**	**99.5**	**101 781**	**14**
Total Oceania	**21**	**99.8**	**11 656**	**6**
Total South America	**14**	**100.0**	**118 295**	**14**
World	**205**	**99.9**	**1 196 168**	**30**

FIGURE 5.1
Proportion of forest area designated for production by country, 2010

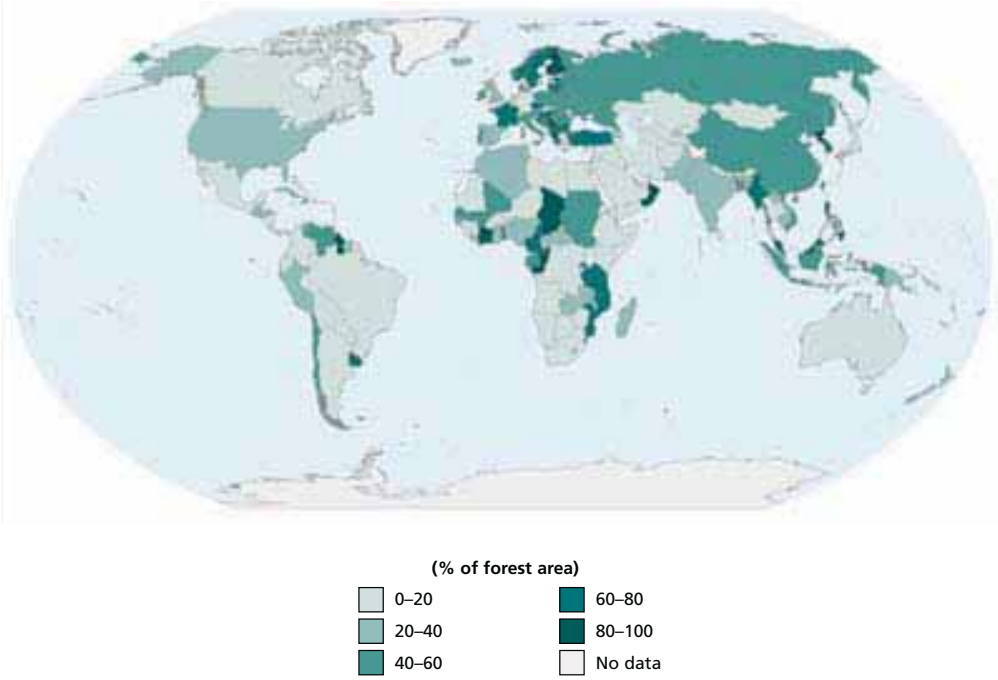


TABLE 5.2
Trends in area of forest designated for production by region and subregion, 1990–2010

Region/subregion	Information availability		Area of forest designated for production (1 000 ha)			Annual change (1 000 ha)		Annual change rate (%)	
	Number of countries	% of total forest area	1990	2000	2010	1990–2000	2000–2010	1990–2000	2000–2010
Eastern and Southern Africa	21	80.9	71 280	65 961	61 156	-532	-480	-0.77	-0.75
Northern Africa	7	99.1	39 557	36 637	36 819	-292	18	-0.76	0.05
Western and Central Africa	22	52.5	100 108	100 095	88 052	-1	-1 204	0	-1.27
Total Africa	**50**	**69.2**	**210 944**	**202 693**	**186 027**	**-825**	**-1 667**	**-0.40**	**-0.85**
East Asia	4	90.2	126 936	119 592	94 711	-734	-2 488	-0.59	-2.31
South and Southeast Asia	17	100.0	114 809	128 657	124 239	1 385	-442	1.15	-0.35
Western and Central Asia	23	99.7	9 566	9 685	9 529	12	-16	0.12	-0.16
Total Asia	**44**	**95.8**	**251 311**	**257 934**	**228 479**	**662**	**-2 945**	**0.26**	**-1.21**
Europe excl. Russian Federation	44	98.2	111 363	111 229	108 829	-13	-240	-0.01	-0.22
Total Europe	**45**	**99.7**	**558 042**	**522 666**	**524 620**	**-3 538**	**195**	**-0.65**	**0.04**
Caribbean	11	53.1	879	860	1 028	-2	17	-0.21	1.80
Central America	3	36.9	1 743	1 620	1 522	-12	-10	-0.73	-0.62
North America	5	100.0	80 560	87 506	97 138	695	963	0.83	1.05
Total North and Central America	**19**	**97.8**	**83 181**	**89 986**	**99 689**	**680**	**970**	**0.79**	**1.03**
Total Oceania	**19**	**99.6**	**7 241**	**11 180**	**11 569**	**394**	**39**	**4.44**	**0.34**
Total South America	**10**	**85.1**	**70 857**	**75 866**	**80 827**	**501**	**496**	**0.69**	**0.64**
World	**187**	**90.6**	**1 181 576**	**1 160 325**	**1 131 210**	**-2 125**	**-2 911**	**-0.18**	**-0.25**

In Northern Africa the reported decline of 292 000 ha per year between 1990 and 2000 was halted after 2000 as a result of an increase in production forest area in Morocco and Tunisia. By contrast, the production forest area in Western and Central Africa has declined after 2000 as Gabon, Liberia and Nigeria reported a substantial decrease in production forest area. In Gabon this decrease was a result of a change in the forest legislation in 2001 and a reassignment of forest functions; in Liberia the reported decline was caused by the cancellation of forest concessions after 2005.

In Asia the area of production forest increased at a rate of 662 000 ha per year from 1990 to 2000, while from 2000 to 2010 it decreased by nearly 3 million hectares annually. This development is mainly due to a reduction in the area designated for productive functions in China by close to 30 million hectares between 1990 and 2010, a change in the designation of forest functions and the reclassification of forest areas in Myanmar, as well as a significant decline in productive forest area reported by Indonesia (12.7 million hectares since 1990).

Europe reported a decrease in the production forest area of 3.5 million hectares between 1990 and 2000, and only a very slight increase from 2000 to 2010. The irregular trend in the Caribbean is a result of the deforestation of production forests in Cuba in the middle of the 1990s followed by an increase in area of production forests through the establishment of planted forests.

South America, North America and Oceania report a steady increase in forest area primarily designated for production since 1990, with the largest increases being seen in Brazil (21.5 million hectares), the United States of America (13.4 million hectares), Mexico (3.2 million hectares) and Papua New Guinea (3.1 million hectares). With the notable exception of Papua New Guinea, where the increase is due to the allocation of new timber concessions on land held under customary ownership, this is mainly a result of the large-scale establishment of planted forests with production as the primary

function. Peru reports a remarkable decrease in production forest area of 15 million hectares since 2000 due to a change in forest legislation favouring the designation of forest area for conservation and protection.

Conclusions

The reported 1.2 billion hectares of forest area primarily designated for production gives an indication of the importance of this function. However, it is a considerable underestimate of the available forest resource base for the production of wood and non-wood forest products, as a substantial part of the 949 million hectares of forest area assigned to multiple use also has productive functions. Furthermore, the removal of NWFPs is often allowed in parts of areas designated for the protection of soil and water resources or the conservation of biological diversity.

The decrease over time reflects an increased reliance on planted forests and more intensively managed natural forests for wood production and a partial shift in designation from production to multiple use.

PLANTED FORESTS

Introduction

Planted forests are composed of trees established through planting and/or through deliberate seeding of native or introduced species. Establishment is either through afforestation on land that until then was not classified as forest, or by reforestation of land classified as forest, for instance after a fire or a storm or following clearfelling. The concept of planted forests is broader than the concept of forest plantations used in previous global assessments. This change was made to capture all planted forests and is in line with the recommendations of the Global Planted Forests Thematic Study 2005 (FAO, 2006d) and recent efforts to develop guidelines and best practices for the establishment and management of planted forests.

Planted forests are established for different purposes and not all of them are designated for production of wood or NWFPs. However, no information was solicited on the area of planted forests designated for productive and protective purposes for FRA 2010. Based on the results of the Global Planted Forests Thematic Study 2005, it is estimated that around 76 percent of planted forests have production as their primary function[17]. This should be kept in mind when interpreting the findings below, which cover all planted forests irrespective of their designated functions.

Status

A total of 203 countries and areas, representing 98.6 percent of the global forest area, reported on their area of planted forests. (Cameroon only reported for 2005. For the purpose of this analysis, this figure has been assumed to be valid for 2010 also.) The total area of planted forest as of 2010 is estimated to be 264 million hectares, corresponding to 6.6 percent of the forest area. The planted forest area by region and subregion is presented in Table 5.3.

East Asia, Europe and North America reported the greatest area of planted forests, together accounting for about 75 percent of global planted forest area. In East Asia planted forests make up 35 percent of the total forest area; most of these are found in China. The second largest area of planted forests is found in Europe, although the share of planted forests here is close to the world average. However, if the Russian Federation with its vast area of natural forest is excluded from Europe, the share of planted forests in Europe increases to 27 percent, the second highest proportion in

[17] This percentage may have decreased since then, as a large proportion of the increase in planted forests has taken place in China and many of these are established for protective purposes (desertification control and protection of soil and water resources).

TABLE 5.3
Area of planted forests by region and subregion, 2010

Region/subregion	Information availability		Area of planted forest	
	Number of countries	% of total forest area	1 000 ha	% of total forest area
Eastern and Southern Africa	23	100.0	4 116	1.5
Northern Africa	8	99.1	8 091	10.3
Western and Central Africa	24	100.0	3 203	1.0
Total Africa	**55**	**100.0**	**15 409**	**2.3**
East Asia	5	100.0	90 232	35.4
South and Southeast Asia	17	100.0	25 552	8.7
Western and Central Asia	23	96.9	6 991	16.6
Total Asia	**45**	**99.8**	**122 775**	**20.8**
Europe excl. Russian Federation	42	97.7	52 327	27.3
Total Europe	**43**	**99.6**	**69 318**	**6.9**
Caribbean	16	70.4	548	11.2
Central America	7	100.0	584	3.0
North America	5	100.0	37 529	5.5
Total North and Central America	**28**	**99.7**	**38 661**	**5.5**
Total Oceania	**18**	**99.7**	**4 101**	**2.1**
Total South America	**13**	**94.6**	**13 821**	**1.7**
World	**203**	**98.6**	**264 084**	**6.6**

the world. North America has the third largest area of planted forests with a share of 5.5 percent of the total forest area in this subregion. Subregions reporting the smallest area of planted forests are the African subregions, the Caribbean, Central America and Western and Central Asia.

In most subregions, the majority of the planted forests are found in just a few countries. For instance, in Northern Africa 75 percent of the planted forest area is located in Sudan; in East Asia, 86 percent is found in China; and in South and Southeast Asia, 90 percent is in India, Indonesia, Malaysia, Thailand and Viet Nam. Some arid zone countries (Cape Verde, Egypt, Kuwait, Libyan Arab Jamahiriya, Oman, United Arab Emirates) and the Netherlands report that all their forests have been established through planting or deliberate seeding.

In total, there are 33 countries with a planted forest area above 1 million hectares which together account for 90 percent of the global planted forest area (see Figure 5.2). Of these, China, the United States of America, the Russian Federation, Japan and India together account for more than half the world's planted forests (53 percent).

The area of planted forest reported for FRA 2010 is lower than that reported in the Global Planted Forests Thematic Study 2005 (FAO, 2006d). A comparison of the figures recorded for 2005 in FRA 2010 with the estimates for 2005 provided in the Thematic Study reveals a difference of more than 38 million hectares, with the figures presented in FRA 2010 being 14 percent lower than the figures in the Thematic Study. The difference is mainly caused by revised estimates provided for FRA 2010 by India (down by more than 20 million hectares), China and the Republic of Korea in Asia, and by France, Germany, Portugal, Romania and Sweden in Europe, as well as missing estimates from Austria and the Bolivarian Republic of Venezuela.

In FRA 2010 countries also reported on the use of introduced species in the establishment of planted forests. Globally, of the 233 countries and areas included, 90 reported that they have planted introduced species, while 17 countries reported that they have not used introduced species in the establishment of planted forests. The remaining 116 countries and areas did not report on the use of introduced species.

FIGURE 5.2
Area of planted forest by country, 2010

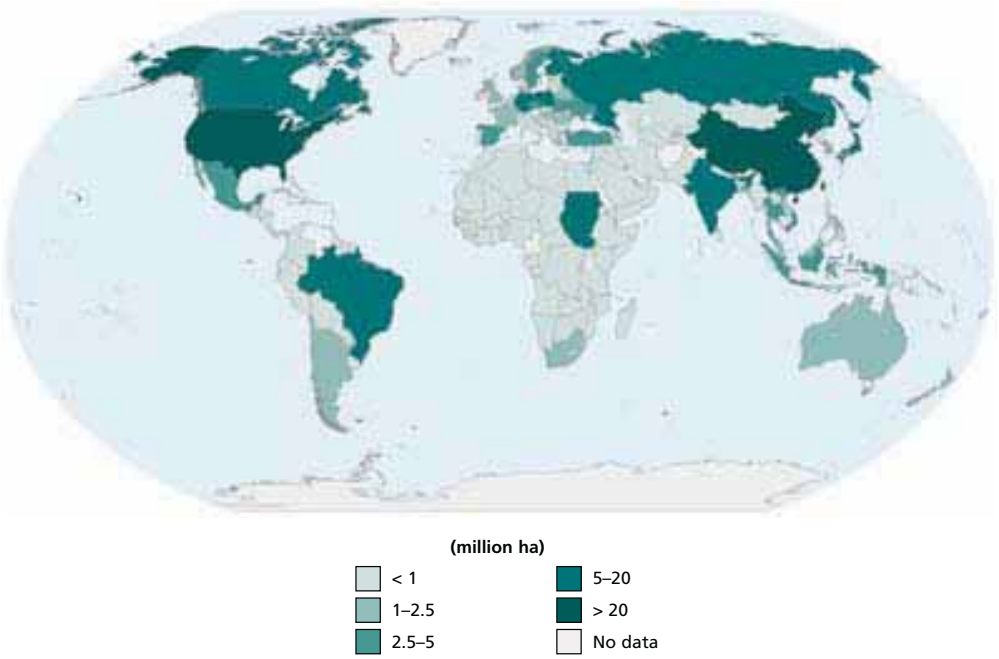


TABLE 5.4
Use of introduced species in planted forests by region and subregion, 2010

Region/subregion	Information availability		Area of planted forest		Area of planted forest comprising primarily of introduced species	
	Number of countries	% of total forest area	1 000 ha	% of total area of planted forest	1 000 ha	% of planted forest area
Eastern and Southern Africa	13	37.1	3 012	73	3 007	99.8
Northern Africa	5	97.5	7 449	92	481	6.5
Western and Central Africa	12	26.5	1 778	56	1 251	70.4
Total Africa	**30**	**39.0**	**12 239**	**79**	**4 740**	**38.7**
East Asia	2	83.7	89 306	99	22 828	28.9
South and Southeast Asia	6	27.7	10 846	42	1 735	16.0
Western and Central Asia	12	47.0	4 445	64	162	3.6
Total Asia	**20**	**53.2**	**104 596**	**85**	**24 725**	**26.2**
Europe excl. Russian Federation	30	82.2	41 913	80	7 183	17.1
Total Europe	**31**	**96.5**	**58 904**	**85**	**7 183**	**12.2**
Caribbean	11	67.0	519	95	164	31.6
Central America	3	44.8	94	16	76	80.7
North America	3	44.8	25 364	68	435	1.7
Total North and Central America	**17**	**45.0**	**25 977**	**67**	**675**	**2.6**
Total Oceania	**10**	**84.5**	**3 931**	**96**	**3 027**	**77.0**
Total South America	**9**	**76.0**	**12 375**	**90**	**12 019**	**97.1**
World	**117**	**66.6**	**218 022**	**83**	**52 369**	**25.2**

The results are compiled in Table 5.4. It should be noted that they refer only to those 117 countries that reported on the use of introduced species. Together, they account for 67 percent of all forests and 83 percent of all planted forests.

At the global level introduced species grow on one quarter (25 percent) of the planted forest area of the countries that reported on this variable. However, there are marked differences by region and subregion. In the tropical and subtropical regions a number of countries with a significant area of planted forest report that they almost exclusively use introduced species for the establishment of planted forests. This is particularly the case in Eastern and Southern Africa (Kenya, Madagascar, Malawi, South Africa, Uganda and Zimbabwe) and in Western and Central Africa (Burundi, Cape Verde and Niger). Planted forests are also predominantly composed of introduced species in Oceania (New Zealand) and in South America (Argentina, Bolivia, Brazil, Chile, Ecuador and Uruguay). In East Asia, China uses introduced species on around one quarter (28 percent) of the planted forest area while Japan did not report. In South and Southeast Asia a number of countries with a significant area of planted forest did not report on the use of introduced species (Indonesia, Malaysia, Thailand and Viet Nam). In Western and Central Asian countries (e.g. Turkey) the use of introduced species is very low, while other countries in this subregion did not report. In the temperate and boreal regions of Europe and North America and in the arid zone countries of Northern Africa introduced species are only used to a minor extent.

Trends

The analysis of trends in the extent of planted forests is based on 203 countries that reported an almost complete time series from 1990 to 2010. Sixteen countries and areas did not provide a complete time series (Cameroon, Ecuador, Estonia, French Polynesia, Guyana, Honduras, Indonesia, Jordan, Lebanon, Mexico, Nicaragua, Niue, Portugal, Republic of Korea, Samoa and Saint Vincent and the Grenadines). In these cases a reasonable estimate was added to the database in order to obtain a comparable total for regions and subregions. The missing data for 1990 and 2000 were estimated to be the same as the reported numbers for 2000 and 2005 respectively. The missing figure for 2010 for Cameroon was estimated to be the same as that reported for 2005. Where a clear trend could be observed in the figures reported for 2000, 2005 and 2010 this trend was extrapolated to complement the missing year 1990. Thirty countries and areas did not report any figures from 1990 to 2010 and were excluded from the analysis. The results are shown in Table 5.5.

Since 1990 the planted forest area has steadily increased in all regions and subregions. At the global level, the planted forest area increased by more than 3.6 million hectares per year from 1990–2000, by 5.6 million hectares per year from 2000–2005, and by 4.2 million hectares per year from 2005–2010. In the last decade the planted forest area has increased by an average of almost 5 million hectares every year.

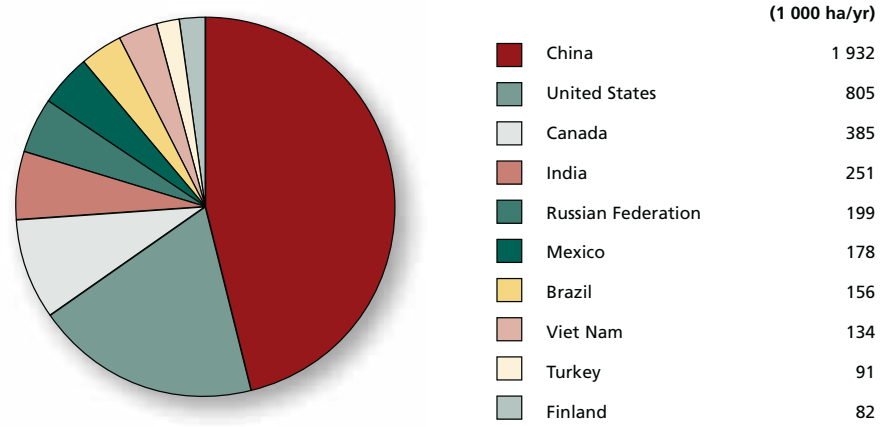
The steadily rising trend in planted forest area varies considerably among subregions. Figure 5.3 presents the trends for the ten countries with the highest annual increase in planted forest areas, with China taking the first rank in the past 20-year period, followed by the United States of America, Canada and India. These four countries together account for an average annual increase in planted forests of 3.3 million hectares over this period.

Although there was a significant increase in planted forest area on a global and regional scale, there are some countries that report a loss in planted forest area. The largest annual decrease in planted forest area over the last 20 years was reported by the Democratic People's Republic of Korea (an average loss of 17 000 ha per year over the last 20 years).

TABLE 5.5
Trends in area of planted forests by region and subregion, 1990–2010

Region/subregion	Information availability		Area of planted forest (1 000 ha)				Annual change (1 000 ha)		Annual change rate (%)	
	Number of countries	% of total forest area	1990	2000	2005	2010	1990–2000	2000–2010	1990–2000	2000–2010
Eastern and Southern Africa	23	100.0	3 500	3 689	3 813	4 116	19	43	0.53	1.10
Northern Africa	8	100.0	6 794	7 315	7 692	8 091	52	78	0.74	1.01
Western and Central Africa	25	94.0	1 369	1 953	2 526	3 203	58	125	3.62	5.07
Total Africa	**56**	**97.1**	**11 663**	**12 958**	**14 032**	**15 409**	**129**	**245**	**1.06**	**1.75**
East Asia	5	100.0	55 049	67 494	80 308	90 232	1 244	2 274	2.06	2.95
South and Southeast Asia	17	100.0	16 531	19 736	23 364	25 552	321	582	1.79	2.62
Western and Central Asia	23	96.9	4 678	5 698	5 998	6 991	102	129	1.99	2.07
Total Asia	**45**	**99.8**	**76 258**	**92 928**	**109 670**	**122 775**	**1 667**	**2 985**	**2.00**	**2.82**
Europe excl. Russian Federation	42	97.7	46 395	49 951	51 539	52 327	356	238	0.74	0.47
Total Europe	**43**	**99.6**	**59 046**	**65 312**	**68 502**	**69 318**	**627**	**401**	**1.01**	**0.60**
Caribbean	16	70.4	391	394	445	548	0	15	0.09	3.33
Central America	7	100.0	445	428	474	584	-2	16	-0.37	3.14
North America	5	100.0	19 645	29 438	34 867	37 529	979	809	4.13	2.46
Total North and Central America	**28**	**99.7**	**20 481**	**30 261**	**35 787**	**38 661**	**978**	**840**	**3.98**	**2.48**
Total Oceania	**18**	**99.7**	**2 583**	**3 323**	**3 851**	**4 101**	**74**	**78**	**2.55**	**2.12**
Total South America	**13**	**94.6**	**8 276**	**10 058**	**11 123**	**13 821**	**178**	**376**	**1.97**	**3.23**
World	**203**	**98.6**	**178 307**	**214 839**	**242 965**	**264 084**	**3 653**	**4 925**	**1.88**	**2.09**

FIGURE 5.3
Ten countries with greatest annual increase in planted forest area, 1990–2010



Conclusions

The country reports for FRA 2010 report a planted forest area of 264 million hectares corresponding to 6.6 percent of the forest area of the reporting countries. At the global level this area has steadily increased since 1990 by an average of 4.3 million hectares per year. In most regions except for Europe and North America the rate of establishment of planted forests increased in the past ten years compared with the previous decade,

although it appears to have peaked during 2000–2005. Given this trend, a further rise in the planted forest area up to 300 million hectares by 2020 can be anticipated. Planted forests are therefore expected to increasingly contribute to the world's wood, fibre, fuel and NWFPs supply, as well as providing environmental and social services at a time when demand for these resources is increasing. The impact of this development on timber markets should be considered by policy-makers, planners and forest managers and supported by outlook studies that evaluate the future contribution of planted forests to economic, environmental and social services. To supply the data needed for such analysis, it is recommended that future assessments estimate the proportion of planted forests designated for different functions.

AFFORESTATION AND REFORESTATION

Introduction

In view of the growing significance of planted forests and to enable countries to report on progress towards the Global Objectives on Forests, the parameters 'afforestation' and 'reforestation' were included in FRA 2010.

Afforestation is the act of establishing forests through planting and/or deliberate seeding on land that is not classified as forest, while reforestation refers to the re-establishment of forest through planting and/or deliberate seeding on land classified as forest, for instance after a fire, storm or following clearfelling. No attempt was made to quantify the area of forest regenerated through natural or assisted natural regeneration in FRA 2010. Afforestation implies an increase in forest area through the conversion of land not bearing forest to forested land, while reforestation does not have an impact on the size of the total area of forest. It should be kept in mind that afforestation and reforestation are not only aimed at establishing planted forests to fulfill productive purposes. However, all afforestation and reforestation efforts are reported in this chapter regardless of their intended purpose.

From a global perspective reporting on these two parameters is fragmented (Table 5.6).

Since afforestation and reforestation activities may vary slightly between the years, countries were asked to report the average area afforested or reforested over a five-year period centred around the years 1990, 2000 and 2005. Of the 233 countries and areas covered by FRA 2010, 29 countries (12 percent) reported that they did not currently carry out any afforestation or reforestation measures and 74 countries (32 percent) did not report at all for 1990, 2000 and 2005. However, most of these countries and areas are small and would not influence the global figures in a significant way. Both afforestation and reforestation measures were reported by 60 countries

TABLE 5.6
Country reporting on afforestation and reforestation by region, 2005

Region	Total number of countries	Number of countries that reported....				Number of countries that did not report
		both afforestation and reforestation	only afforestation	only reforestation	zero afforestation and reforestation*	
Africa	57	10	14	14	8	11
Asia	48	17	3	10	4	14
Europe	50	24	5	3	5	13
North and Central America	39	3	6	5	6	19
Oceania	25	3	2	2	2	16
South America	14	3	0	6	4	1
World	**233**	**60**	**30**	**40**	**29**	**74**

* Including also those countries which reported zero for one of the categories and no data for the other.

(26 percent), while 30 countries (13 percent) reported only afforestation and 40 countries (17 percent) only reforestation measures (see Table 5.6). Reported figures for 1990, covering the period 1988 to 1992, appear incomplete. More complete datasets were reported for 2000 (covering the period 1998 to 2002) and for 2005 (covering the period 2003 to 2007). Therefore, status and trends of afforestation and reforestation measures were analysed and interpreted for regions and subregions only for the ten-year period from 1998 to 2007.

Status

Table 5.7 gives a summary by region and subregion of the status of afforestation and reforestation in 2005, covering the period 2003 to 2007, based on information from 163 countries and areas, which account for 95 percent of the total forest area and 98 percent of the total area of planted forests.[18]

At the global level, an average of 5.6 million hectares per year were reported for afforestation and 5.3 million hectares per year for reforestation. Together, this area (about 11 million hectares) is more than twice the reported average annual increase in the area of planted forests during the period 2000–2010 (see Table 5.5). In part, this difference can be explained by the fact that countries were asked to report on the area planted or sown annually, not the area of forest established. Gross figures for afforestation and reforestation were therefore reported, which did not take into account the fact that survival or establishment rates can be low – particularly for afforestation aimed at desertification control such as in China and Northern Africa. Furthermore, part of the reforestation involved replanting previously existing planted forests (see below) and, therefore, did not result in an increase in the overall area of planted forests. Some countries reported that areas of planted forests had been converted to other land uses during the period. For example, in Malaysia rubber plantations have been converted to other uses – in some cases oil palm plantations.

TABLE 5.7
Afforestation and reforestation by region and subregion, 2005

Region/subregion	Afforestation (ha/yr)	Reforestation (ha/yr)
Eastern and Southern Africa	58 933	105 226
Northern Africa	53 250	28 024
Western and Central Africa	47 930	103 873
Total Africa	**160 113**	**237 123**
East Asia	4 385 209	361 288
South and Southeast Asia	398 053	2 067 129
Western and Central Asia	142 406	50 384
Total Asia	**4 925 668**	**2 478 801**
Total Europe	**169 657**	**992 540**
Caribbean	45	7 664
Central America	4 328	14 728
North America	199 362	853 815
Total North and Central America	**203 735**	**876 207**
Total Oceania	**59 381**	**37 423**
Total South America	**103 879**	**722 527**
World	**5 622 433**	**5 348 017**

[18] The figures on reforestation from the Russian Federation include areas under natural regeneration. Based on the information on afforestation and change in area of planted forests, it is estimated that the area of reforestation amounts to 40 percent of the total area regenerated. The reforestation area has been adjusted accordingly for the purpose of this chapter.

Since oil palm is an agricultural tree crop the area thus moved from the class 'planted forests' to 'other land with tree cover', which counterbalances some of the increase. Finally, a few countries in Europe (e.g. Belgium) noted that some planted forests had been re-established through natural regeneration in the period and these areas then moved from the category 'planted forests' to 'other naturally regenerated forests'. All these factors would result in a lower net increase in the area of planted forest compared with the area of afforestation and reforestation. However, the significant difference between the gross planting rates and the net increase in planted forests warrants further analysis and points to the need for more detailed information in future assessments, including estimates of survival rates for newly planted areas.

East Asia showed a very high level of afforestation, with around 4.4 million hectares per year on average for 2005, of which more than 99 percent were reported by China. Introduced species were used for 28 percent of afforestation in East Asia which is in line with the global figure (see Table 5.8). Reforestation activities, in contrast, were greatest in South and Southeast Asia[19], with 2.1 million hectares annually, and in Europe with 1.0 million hectares per year. In both regions the proportion of introduced species used in reforestation was low.

The ten countries with the highest planting rates for afforestation and reforestation in 2005 are shown in Figures 5.4 and 5.5.

Of the 100 countries that reported some reforestation, 35 reported on the proportion of this area that was previously planted. Together these countries account for just over

TABLE 5.8
Use of introduced species in afforestation and reforestation, 2005

Region/ subregion	Afforestation				Reforestation			
	Information availability		Area reforested (ha/yr)	% of introduced species	Information availability		Area reforested (ha/yr)	% of introduced species
	Number of reporting countries	% of total forest area			Number of reporting countries	% of total forest area		
Eastern and Southern Africa	16	75.2	52 208	100	12	35.6	101 816	99
Northern Africa	6	98.8	53 250	36	3	3.5	9 900	58
Western and Central Africa	11	22.6	15 867	69	12	32.9	77 954	85
Total Africa	**33**	**52.3**	**121 325**	**68**	**27**	**30.6**	**189 670**	**91**
East Asia	1	79.8	4 385 000	28	2	82.4	324 781	27
South and Southeast Asia	3	0.3	28	100	4	7.2	33 113	94
Western and Central Asia	10	13.8	14 170	7	10	14.9	3 674	13
Total Asia	**14**	**34.2**	**4 399 198**	**28**	**16**	**38.9**	**361 568**	**33**
Total Europe	**26**	**93.2**	**121 391**	**19**	**29**	**94.4**	**1 562 659**	**3**
Caribbean	8	17.3	35	100	8	45.9	6 864	59
Central America	2	17.4	3 141	80	0	–	–	
North America	1	44.6	121 532	2	0	–	–	
Total North and Central America	**11**	**43.5**	**124 708**	**4**	**8**	**0.4**	**6 864**	**59**
Total Oceania	**9**	**84.6**	**59 381**	**22**	**7**	**5.9**	**37 423**	**100**
Total South America	**6**	**9.6**	**87 531**	**99**	**7**	**75.0**	**627 980**	**98**
World	**99**	**50.5**	**4 913 534**	**29**	**94**	**50.7**	**2 786 163**	**36**

[19] This includes afforestation efforts in India, where it was not possible to break down national figures of tree planting into afforestation and reforestation.

FIGURE 5.4
Ten countries with largest area of afforestation, 2005

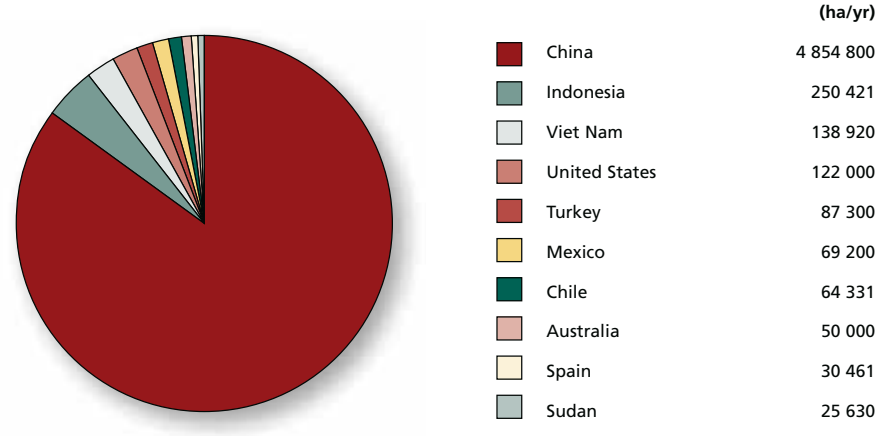
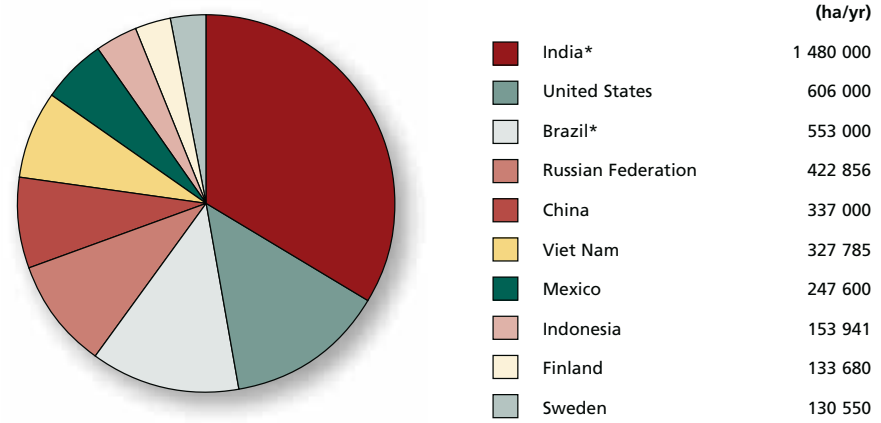


FIGURE 5.5
Ten countries with largest area of reforestation, 2005



* Includes afforestation

one-third of the total forest area (36 percent), 58 percent of the total area of planted forests and 38 percent of the total area reforested. In these countries, some 72 percent of all the reforestation undertaken in and around year 2005 took place on areas that were previously planted, while some 576 000 hectares of naturally regenerated forests were converted to planted forests annually. However, due to the limited information availability, this result should be treated with caution.

Reporting on the use of introduced species in afforestation and reforestation is fragmented. Of the 233 countries and areas covered by FRA 2010, only 99 countries (51 percent) reported on the use of introduced species in afforestation and 94 countries (51 percent) on the use of introduced species in reforestation. Together, they account for 87 percent of the total area afforested and 52 percent of the area reforested. Table 5.8 gives a summary by region and subregion for 2005.

At the global level introduced species were used at a rate of 29 percent in afforestation and 36 percent in reforestation in the reporting countries. However, marked differences existed in the use of introduced species, by region and subregion.

The reporting countries of the tropical and subtropical regions almost exclusively used introduced species for afforestation and reforestation, particularly in Eastern and Southern Africa (Kenya, Madagascar, Malawi and South Africa); South and Southeast Asia (e.g. Malaysia) and the Caribbean. However a number of countries with a significant area of planted forest did not report on the use of introduced species in afforestation and reforestation (Indonesia, Thailand and Viet Nam). In Oceania (New Zealand) and South America (Argentina, Brazil and Chile) introduced species also predominated in afforestation and reforestation. In East Asia, China used introduced species on around one quarter (28 percent) of both afforested and reforested areas. Countries in the temperate regions (Western and Central Asia, Europe and North America) used introduced species for afforestation and reforestation only to a minor extent.

Trends

Globally there has been a decreasing trend in afforestation and a slight increasing trend in reforestation during the observed ten-year period from 1998 to 2007. The rate of afforestation decreased by 1.0 percent annually and reforestation increased by 0.3 percent when comparing the average for 2000 with that for 2005 for the reporting countries (see Table 5.9). However there are marked differences between the regions and subregions.

African subregions show an increasing trend in afforestation and reforestation, except for Northern Africa. A similar trend can be observed in South and Southeast Asia and in Western and Central Asia. In East Asia (i.e. China) afforestation and reforestation trends are both decreasing, although the afforested area is still the largest in the world. In Europe and North and Central America the annually afforested and reforested areas have considerably decreased, in particular the planting of new

TABLE 5.9
Trends in afforestation and reforestation by region and subregion, 2000–2005

Region/subregion	Afforestation			Reforestation		
	2000 (ha/yr)	2005 (ha/yr)	Annual change rate (%)	2000 (ha/yr)	2005 (ha/yr)	Annual change rate (%)
Eastern and Southern Africa	25 966	48 727	13.42	71 574	101 926	7.33
Northern Africa	46 327	53 250	2.82	28 908	28 024	-0.62
Western and Central Africa	47 300	47 930	0.26	81 117	107 270	5.75
Total Africa	**119 593**	**149 907**	**4.62**	**181 599**	**237 220**	**5.49**
East Asia	4 737 100	4 385 209	-1.53	694 508	361 288	-12.25
South and Southeast Asia	210 633	398 053	13.58	1 833 148	2 067 129	2.43
Western and Central Asia	62 019	142 254	18.06	45 352	48 188	1.22
Total Asia	**5 009 752**	**4 925 516**	**-0.34**	**2 573 008**	**2 476 605**	**-0.76**
Total Europe	**273 812**	**169 250**	**-9.17**	**1 204 892**	**989 754**	**-3.86**
Caribbean	41	35	-3.11	6 323	7 664	3.92
Central America	10 088	4 328	-15.57	11870	14 728	4.41
North America	250 873	199 362	-4.49	982 026	853 815	-2.76
Total North and Central America	**261 002**	**203 725**	**-4.83**	**1 000 219**	**876 207**	**-2.61**
Total Oceania	**128 167**	**59 339**	**-14.27**	**37 277**	**37 054**	**-0.12**
Total South America	**93 287**	**87 531**	**-1.27**	**247 225**	**714 418**	**23.64**
World	**5 885 614**	**5 595 268**	**-1.01**	**5 244 219**	**5 331 258**	**0.33**

forest areas through afforestation, while in South America the rate of reforestation is increasing rapidly.

Conclusions

During the period from 1998 to 2007 afforestation and reforestation have made a substantial impact on the development of forest resources. At the global level, afforestation measures, together with natural expansion of forests in some countries and regions, have helped reduce the net loss of forest area to 8.3 million hectares annually in the 1990s and to 5.2 million hectares per year in the last decade, compared with the gross rate of loss through deforestation and natural causes, estimated at 16 million hectares per year in the 1990s and 13 million hectares per year in the last decade.

Reforestation has contributed to maintaining forests on more than 5 million hectares of land per year on average from 1998 to 2007. Both afforestation and reforestation rates are reported to have increased in most of the tropical regions, which so far account for the highest loss of forests. Some large countries, in particular China and the United States of America, have slowed their afforestation and reforestation activities although both still feature among the countries with the highest rates of tree planting in the world. The large increase in the area reforested in South America is primarily due to Brazil, where more than 0.5 million hectares are being planted annually – most of this as reforestation.

Reporting on afforestation and reforestation was introduced for the first time in FRA 2010 in an attempt to obtain better information on forest area change dynamics. Although quite a large number of countries were able to report on these variables, the data analysis indicates that there are still significant data issues to be resolved before a complete balance sheet can be reported by countries displaying forest loss (through deforestation and natural causes) and forest gain (through afforestation and natural expansion of forests) over time.

REMOVALS OF WOOD PRODUCTS

Introduction

Wood removed from forests and other wooded land constitutes an important component of the productive function. The volume of wood removed indicates the economic and social utility of forest resources to national economies and dependent local communities. This information also contributes to monitoring the use of forest resources by comparing actual removals with the sustainable potential.

Industrial roundwood and woodfuel were reported separately for FRA 2010. For 1990, 2000 and 2005, the data reported are five-year averages for 1988–1992, 1998–2002 and 2003–2007 respectively.

As a check on the quality and consistency of the information, the reports for FRA 2010 were compared with the removals statistics published in the FAOSTAT database[20] (FAO, 2009b). This detailed examination of the data revealed a number of differences between the two sources in absolute numbers, particularly for woodfuel removals. At the global level, wood removals figures reported for FRA 2010 are about 15 percent lower than those in FAOSTAT (5 percent lower for industrial roundwood and 25 percent lower for woodfuel). Lower absolute figures reported for FRA 2010 may be explained by the fact that not all countries reported removals, some reported removals from forest only and a few did not include removals from plantations. FAOSTAT includes removal estimates from all sources (i.e. forest and non-forest land), as well as woodfuel estimates generated by FAO for the countries that do not report reliable removals statistics (Whiteman, Broadhead and Bahdon, 2002). In spite of the

[20] FAOSTAT wood removal figures were recalculated into 5-year average volume over bark by using the conversion ratio 1.15.

divergence between these sources, global and regional trends for removals are similar in the two datasets.

Status

Data on wood removals in 2005 were available for 172 countries that account for 99.8 percent of the global forest area. The majority of countries (101) reported data for removals from forest only, while 22 countries provided data for wood removals broken down by source (forest and other wooded land) and another 49 countries did not specify the source of wood removals.

Reported global wood removals in 2005 amounted to 3.4 billion cubic metres, of which about half were industrial roundwood and half woodfuel (see Table 5.10)[21]. Reported wood removals from other wooded land amounted to about 299 million cubic metres, or 9 percent of total wood removals in 2005. The true figure (as well as total volume of removals) was probably much higher because most of the countries only reported removals from forests or did not specify the source of wood removals. India accounted for the majority of reported removals from other wooded land (252 million cubic metres, which constitutes 82 percent of the total wood removals in the country).

In Africa, the Caribbean, Central America and South and Southeast Asia removals were mainly woodfuel, while in North America, East Asia, Europe and Oceania removals were mainly industrial roundwood. In South America removals were evenly distributed between industrial roundwood and woodfuel.

The ten countries reporting the highest figures for wood removals account for just below 60 percent of total global removals (see Figure 5.6).

TABLE 5.10
Wood removals by region and subregion, 2005

Region/subregion	Industrial roundwood	Woodfuel		Total removals
	million m³	million m³	% of total	million m³
Eastern and Southern Africa	39	292	88	331
Northern Africa	4	24	87	27
Western and Central Africa	30	301	91	330
Total Africa	**72**	**616**	**90**	**688**
East Asia	86	71	45	157
South and Southeast Asia	99	464	82	562
Western and Central Asia	17	13	43	30
Total Asia	**201**	**548**	**73**	**749**
Total Europe	**568**	**167**	**23**	**735**
Caribbean	1	5	82	6
Central America	4	17	81	22
North America	701	55	7	756
Total North and Central America	**706**	**77**	**10**	**783**
Total Oceania	**55**	**1**	**1**	**56**
Total South America	**180**	**167**	**48**	**347**
World	**1 783**	**1 576**	**47**	**3 359**

[21] Some countries only provided information on removals of woodfuel or industrial roundwood and did not present a total on the FRA questionnaire. In such cases, these figures were used for the totals in the analysis and were included in the tables presented here.

FIGURE 5.6
Ten countries with largest volume of wood removals in percent, 2005

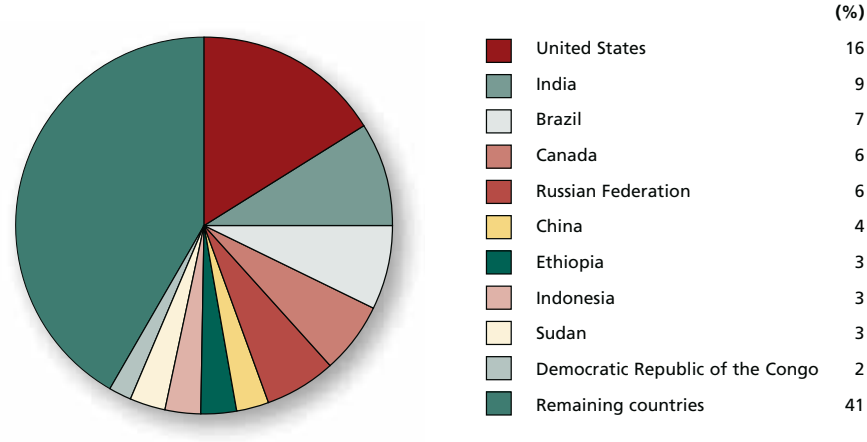


TABLE 5.11
Trends in wood removals by region and subregion, 1990–2005

Region/subregion	Wood removals (million m³)								
	Industrial roundwood			Woodfuel			Total		
	1990	2000	2005	1990	2000	2005	1990	2000	2005
Eastern and Southern Africa	28	31	35	140	162	174	168	193	209
Northern Africa	3	3	4	21	22	24	24	25	27
Western and Central Africa	20	24	24	222	277	297	242	301	322
Total Africa	**51**	**59**	**63**	**383**	**461**	**495**	**434**	**519**	**558**
East Asia	98	77	86	70	83	71	168	161	157
South and Southeast Asia	123	92	99	466	459	463	589	551	561
Western and Central Asia	15	16	17	18	14	13	33	30	30
Total Asia	**237**	**186**	**201**	**554**	**556**	**547**	**791**	**741**	**748**
Total Europe	**603**	**486**	**560**	**163**	**145**	**164**	**766**	**631**	**723**
Caribbean	1	1	1	5	5	5	6	6	6
Central America	2	3	3	16	17	16	18	19	19
North America	696	715	701	105	56	55	801	771	756
Total North and Central America	**699**	**719**	**705**	**126**	**77**	**76**	**825**	**796**	**781**
Total Oceania	**33**	**48**	**55**	**0**	**0**	**1**	**34**	**48**	**56**
Total South America	**153**	**142**	**178**	**196**	**164**	**167**	**349**	**306**	**344**
World	**1 777**	**1 640**	**1 762**	**1 422**	**1 403**	**1 449**	**3 199**	**3 043**	**3 211**

Trends

Table 5.11 is based on 159 countries and areas that provided a complete time series on wood removals. Those reporting both industrial roundwood and woodfuel for all three years account for about 97 percent of the global forest area.

At the global level, total removals increased between 2000 and 2005 after a fall in the 1990s and the proportions of industrial roundwood and woodfuel did not change significantly when comparing 1990 to 2005. However, the trends varied between regions.

African countries reported steadily increasing wood removals: from 434 million cubic metres in 1990 to 558 million cubic metres in 2005. The average annual growth of 3 percent in wood removals in Africa is in line with population growth over the same period.

East Asia reported a decline in removals, caused primarily by a significant decrease in wood removals in China as a result of a partial logging ban, as well as a continuous decline in Japan. South and Southeast Asia reported a significant decline during the 1990s, particularly for industrial roundwood caused by log export restrictions in Malaysia and Indonesia. Between 2000 and 2005, removals rose slightly in this region because of a reported increase in India and Malaysia. For Asia as a whole, total reported removals declined from 791 million cubic metres in 1990 to 748 million cubic metres in 2005. However, the figure for 2005 is an underestimate by at least 50 million cubic metres because China, Indonesia and Thailand provided only partial data and, for example, did not include wood removals from rubber plantations. Southeast Asia and China experienced a significant shift from logging in natural forests to planted forests over the two decades. The actual wood removals in Asia are now probably higher than during the 1990s.

A sharp decline in removals in the Russian Federation in the early 1990s – a result of the transition from a centrally-planned to a market-based economy – caused an overall reduction in removals in Europe of 8 percent between 1990 and 2000. However, following this decrease, removals in Europe including the Russian Federation have been moving back towards their 1990 level. Removals in Europe excluding the Russian Federation have been growing steadily, at an average annual rate of 1.5 percent over the period 1990 to 2005.

North and Central America show a very stable trend over the last 15 years: total removals decreased gradually from 825 million cubic metres in 1990 to 781 million cubic metres in 2005.

A steady increase in removals was reported for Oceania. Four countries (Australia, New Zealand, Papua New Guinea and Solomon Islands) account for most of the wood removals, which nearly doubled from 34 million cubic metres in 1990 to 56 million cubic metres in 2005 because of an increased supply of industrial roundwood from forest plantations in New Zealand and Australia.

South America reported a significant reduction, from 349 million cubic metres in 1990 to 306 million cubic metres in 2000, mainly due to reduced logging in Brazil's natural forests. However, after 2000 removals bounced back to the level of 1990. Similar to Oceania, a growing supply of industrial roundwood from forest plantations (Brazil, Chile, Argentina and Uruguay) accounted for most of this increase in removals.

Conclusions

In the long term, wood removals are gradually increasing globally in line with growing populations and income, which in turn translate into higher demand for and consumption of wood products. This trend will continue in the next decades.

Globally, wood removals account for 0.7 percent of growing stock and nearly half of this wood is used as woodfuel. However, significant differences exist between regions, with more than two thirds of wood used as woodfuel in Africa and Asia and less than 20 percent in Europe, North America and Oceania.

Most of the long-term growth in wood supply is occurring in countries that developed forest plantations over the last few decades (in Asia, Latin America and Oceania). In spite of some data limitations, it is evident that wood supply (particularly industrial roundwood) is shifting from natural forests to planted forests. This means that pressure on natural forests as a wood source is likely to diminish further in future.

REMOVALS OF NON-WOOD FOREST PRODUCTS

Introduction

Information on removals of NWFPs demonstrates their importance, both as commodities for national and international markets, and for the livelihoods of

many local and indigenous people who depend on them. This information shows that NWFPs often deserve a higher priority in the development of national poverty alleviation policies, rural development projects and forest conservation strategies.

A wide variety of products are collected from forests, woodlands and from trees and land outside forests, and a major portion of them are consumed by households or sold locally, while some find export markets. Various products have been – or are being – domesticated. In fact, the borderline between NWFPs (counting as 'forest sector' outputs) and agricultural crops is increasingly blurred. Data collection on forest-based NWFP production is hampered by the inability of agricultural classification and production accounting systems to incorporate both forest and farm-based production, and the inadequacy of human and financial resources in national statistics institutions to gather and analyse NWFP data.

In FRA 2010 NWFPs are defined as 'goods derived from forests that are tangible and physical objects of biological origin other than wood'. As such, NWFPs include all plant and animal products with the exception of 'wood' collected from areas defined as forests, whether natural forests or plantations. From the data provided it is not always possible to distinguish NWFPs from (sometimes the same) products collected on lands under agricultural or agroforestry production systems (for instance, mushrooms, bee products and honey, medicinal plants, nuts, cork, bamboo, hunted animals and gum arabic). The units used for reporting the quantity of NWFP removals are varied and include: number (e.g. of skins and hides), tonnes or kilograms (e.g. of nuts or resin) and cubic metres or litres (e.g. for fodder or palm wine). Sometimes different measures are applied to the same product by different countries. It is therefore not always possible to aggregate totals of NWFP removals at regional or global levels.

A multitude of NWFPs are gathered and consumed, both for subsistence and commercial use, locally and beyond. Quantitative data are difficult to obtain on national production of all NWFPs, so countries were asked to list the ten most important NWFPs in order of importance, under 16 use-based categories. Importance was based on the value (or estimated value) of the removals for the reporting year 2005. (The value of NWFP removals is discussed in Chapter 7.) Countries were asked to report the national output in terms of quantity (and value) by providing the botanical names of the key NWFP species in the following categories:

Plant products/raw material

1. Food
2. Fodder
3. Raw material for medicine and aromatic products
4. Raw material for colorants and dyes
5. Raw material for utensils, handicrafts and construction
6. Ornamental plants
7. Exudates
8. Other plant products

Animal products/raw material

9. Living animals
10. Hides, skins and trophies
11. Wild honey and beeswax
12. Wild meat
13. Raw material for medicine
14. Raw material for colorants
15. Other edible animal products
16. Other non-edible animal products

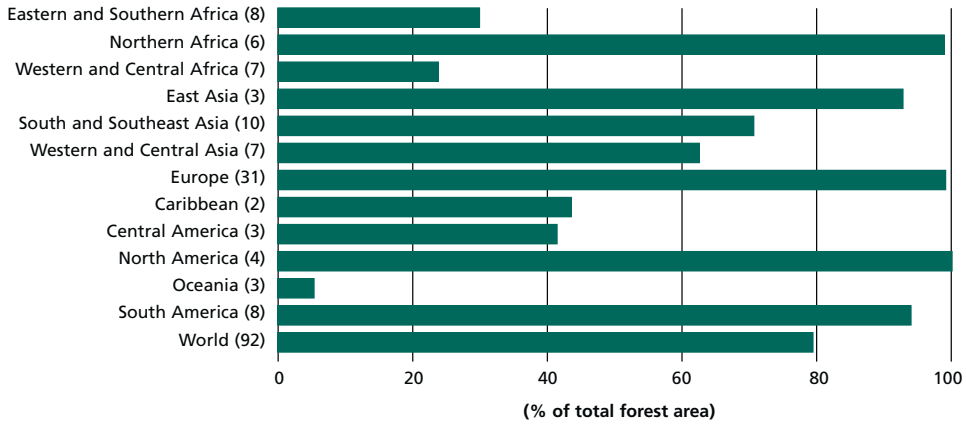
The vast majority of country reports included the botanical names of the species from which the NWFPs were derived. This greatly facilitated follow-up work to check the relevance and consistency of the data, including the reported quantities (and values), as well as whether the reported products could really be considered as NWFPs. The aggregation of national data on the NWFP production categories into regional and global level statistics is difficult and must be treated with caution. Not only have some countries reported the same NWFP species under different categories, but also a single species often yields different categories of NWFP. The aggregation of quantitative production data at regional and global levels is more meaningful when done according to 'species (or groups of similar species)' rather than categories of use.

A section on the status of NWFPs was first included in FRA 2000. In FRA 2005 additional quantitative information was provided on the amount and value of NWFP removals. For FRA 2010 a total of 92 countries (representing 79 percent of the total forest area) reported data on removals of one or more categories of NWFPs, mostly for the reporting year 2005 (see Figure 5.7). However, 141 countries, representing 21 percent of the global forest area, did not report any data at all, even though it is known that NWFPs play a significant role (for example, in the Central African countries and in Papua New Guinea). Where national statistics do exist, data on removals are often limited to those NWFPs that are (inter-)nationally traded. However, many NWFPs are used and consumed non-commercially, so the figures reported are often a significant underestimate of the full range of NWFPs gathered in the country.

The major categories of NWFP removals about which countries provided the most information are (in descending order of importance):

1. Food
2. Exudates
3. Other plant products
4. Wild honey and beeswax
5. Ornamental plants
6. Raw materials for medicine and aromatic products
7. Wild meat
8. Raw materials for utensils, handicrafts and construction
9. Living animals
10. Hides, skins and trophies

FIGURE 5.7
Information availability – NWFP removals, 2005



Note: Numbers in ( ) are number of reporting countries.

There was insignificant or no reporting at all for the remaining categories.

Food was by far the largest of these ten most-reported categories. Asia accounted for the largest share of removals (by volume), almost exclusively comprising NWFPs of plant origin. Only three countries in Asia reported data for animal-derived NWFPs, and in very limited quantities. Asian removals consisted mainly of camellia, oil seeds, nuts and bamboo products. China was the largest producer by far; other countries with significant removal volumes were Republic of Korea, Japan and India. Following these, in decreasing order of importance in the food category were Europe, Oceania, North, Central and South America, and Africa, where a large majority of removals were also from plant-based NWFPs. It is interesting to note that in these regions data on animal-based NWFPs were more common than in Asia. However, the proportion of animal-based NWFP removals remained minimal, with the exception of Europe, which had the highest level of animal-based NWFP removals. The 24 European countries that reported on the animal-based product categories provided the most detailed reports on the contribution of hunting and its products (meat, trophies, skins, etc.).

Exudates were the second largest NWFP category. Sudan was the world's major producer of exudates, with gum arabic. China was the leading producer of pine resin, tannin extract and raw lacquer.

Fodder removals were reported by only 13 countries (compared with 16 in FRA 2005). Nevertheless, some countries – particularly India, Italy, Morocco and Colombia – reported very large quantities, indicating that this was a very important product category, however severely under-reported. Raw materials for utensils, crafts and construction, such as bamboo and rattan, were reported in large quantities from countries such as India and Myanmar. Ornamental plants, palm fronds and boughs were reported in large quantities from several countries in all regions.

The majority of reporting countries (except Asia) included removals of animal products, such as live animals (birds, insects, reptiles and crabs), meat, hides, skins and trophies, as well as wild honey and beeswax. The most comprehensive figures for edible animals (hunting, game products and wild meat) were provided in the reports by the OECD countries of Europe, North America and Oceania (New Zealand and Australia). It is well known, however, that wild meat and animal products are an important source of food in many African, Asian and Latin American countries, but these reported very few figures for this removal category, which may therefore be heavily underestimated.

For the remaining categories of NWFPs, information was provided by a limited number of countries, so the calculation of global totals is not very meaningful. However, some particular subregional aspects are highlighted below.

Africa: Thirty countries, mainly from Northern and Eastern Africa, provided data on their NWFP removals. Data were more limited from Western and Central African countries despite the fact that removals of NWFPs must be important in these countries. Cork, medicinal and aromatic plants, fodder and game meat were the most important NWFP removals reported by Northern African countries. In Eastern and Southern Africa, exudates (mainly gum arabic and frankincense), medicinal plants, fruits, honey and raw materials for handicrafts and construction prevailed. Western and Central African countries reported food (sheanut butter, bushmeat, mushrooms, palm oil and wine), medicinal and aromatic plants, rattan and gums.

Asia: Three East Asian countries (China, Japan and Republic of Korea) provided very complete and comparable responses because of the similarity of their forest resources. However, the sheer size of the removals reported by China dwarfs any other country's output. Bamboo products, mushrooms, nuts and medicinal herbs were the major NWFP removals. Reports from nine South and Southeast Asian countries were less complete but included a more diverse range of NWFP categories, reflecting the more diversified resource base in the region. Bamboo, rattan, food (fruits, nuts, spices

and mushrooms), medicinals and essential oils were among the major NWFP removals reported by these countries. Information from seven Western and Central Asian countries was more fragmented. The key removal categories reported were honey, food (pine and pistachio nuts) and aromatic plants.

Europe: Of the 50 European countries, 31 provided rich information on their NWFP removals. Food was the largest removal category, followed by honey, ornamental plants, wild meat and medicinals. Nuts, mushrooms, berries and honey were mentioned by almost all countries among their most important NWFP removals, followed by Christmas trees (in Northern Europe), hunting, game meat, skins and trophies, and cork (by the Southwestern Mediterranean countries).

North, Central and South America and the Caribbean: Among the Caribbean countries, Cuba reported palm fronds and Trinidad and Tobago wild meat as their major removals. Three Central American countries listed exudates (pine, sweetgum, rosin, maple and balsam), honey and seeds as their key removals. In North America maple products, Christmas trees, resins, berries, furs, boughs and mushrooms were among the major removals mentioned, while resin, nuts, fruits and mushrooms were listed for South America.

Oceania: Only 3 countries (Kiribati, New Zealand and the Solomon Islands) reported on the quantity of NWFPs removed. New Zealand reported honey, sphagnum moss, Christmas trees and hunting products as the major removals, while for the reporting Pacific islands, fibre materials (mainly pandanus leaves, rattan and coconut) for thatching and artisanal works, and food (honey, fruits and juices) were the most frequently reported NWFP removal categories.

Conclusions

Information on NWFPs continues to be poor, despite their importance locally and, in some cases, nationally and internationally.

Based on the information supplied for FRA 2010, food is the largest category of NWFPs globally. Other important categories include exudates, other plant products, wild honey and beeswax, and ornamental plants. Asia, and in particular China, reported the largest volume of NWFP removals, most of which are of plant origin (camellia oil seeds, nuts and bamboo products). The sheer size of the removals reported by China dwarfs any other country's removals. Europe has the highest reported level of animal-based NWFP removals.

Chapter 6

Protective functions of forest resources

OVERVIEW

Early forest resources assessments focused on the productive functions of forests, particularly wood supply, as this was the main issue identified by policy-makers. However, in many countries there is increasing awareness of the protective functions and environmental services provided by forests, and the importance of these for sustainable forest management. With each succeeding FRA, the environmental services provided by forests have gained increasing recognition.

As Leslie (2005) observes, "Current world demand for the products and services of forests is a mix of static or only slightly increasing demand for wood, a steady but slowly increasing demand for non-timber forest products (NTFPs) and a burgeoning, but largely unmonetized demand for environmental services". A large proportion of these services are related to the protective role of forests. As a result, trends in forests that have a protective function were also evaluated for FRA 2010.

In the context of FRA 2010, countries were asked to report on only one variable: the area of forest with 'protection of soil and water as the primary designated function'. The wording 'protective' role or function is thus, in this report, intended to denote forest areas with soil and water conservation as the main function or management objective.

The world's forests have many protective functions, some local and some global, including protection of soils from wind and water erosion, coastal protection, avalanche control, and as air pollution filters. Quantitative and qualitative studies on the role of forests in water regulation, protection and conservation in different natural and man-made ecosystems have been published in a related Thematic Study on Forests and Water (FAO, 2008a).

KEY FINDINGS

Eight percent of the world's forests have protection of soil and water resources as their primary objective

Around 330 million hectares of forest are designated for soil and water conservation, avalanche control, sand dune stabilization, desertification control or coastal protection. The area of forest designated for protective functions increased by 59 million hectares between 1990 and 2010, primarily because of large-scale planting in China aimed at desertification control, conservation of soil and water resources and other protective purposes.

KEY CONCLUSIONS

In view of the many protective functions of forests and their increasing importance, there is a growing imperative for countries to gather, analyse and present information on the extent and condition of forests with a protective function. All forests and woodlands, including productive forests, play a protective role to varying degrees and the protective functions could often be enhanced by an alteration of the management regime. While this might result in income foregone or greater forest management costs (for example, by avoiding harvesting on critical sites or through upgrading harvesting

practices), the value of these environmental services to human welfare, health and economies is increasingly being recognized. Environmental or ecological economics provides new tools for monetizing these services (see, for example, Landell-Mills and Porras, 2002).

FRA 2010 is the second attempt to evaluate the importance of the protective functions of forests at the global level and is based on a limited number of quantitative variables. The findings of FRA 2010 suggest that there is a trend towards increasing identification and designation of forest areas for protective purposes, which is very positive. It would seem likely that the trend for a greater proportion of the world's forests to be classified as having a protective function as the main management objective will continue and that FRA 2015 may show more than 10 percent in this category. The FRA Thematic Study on Forests and Water (FAO, 2008a) provides important recommendations in this respect.

The analysis of FRA 2010 highlights significant regional differences in the area of forests with a protective function. In some cases this is related to the reporting and definition criteria and more specifically to the fact that not all countries have a category for forests with soil and water protective function as a primary use in their national statistics. There is, therefore, a real need to harmonize and clarify the criteria for reporting under this category for FRA 2015.

FOREST AREA DESIGNATED FOR PROTECTIVE PURPOSES

Introduction

One of the most important protective function of forests is related to soil and water resources. Forests conserve water by increasing infiltration, reducing runoff velocity and surface erosion, and decreasing sedimentation (which is particularly relevant behind dams and in irrigation systems). Forests play a role in filtering water pollutants, regulating water yield and flow, moderating floods, enhancing precipitation (e.g. 'cloud forests', which capture moisture from clouds) and mitigating salinity. For FRA 2010 the variable forest area with 'protection of soil and water as the primary designated function' refers specifically to the area of forests that have been set aside for the purposes of soil and water conservation, either by legal prescription or by decision of the landowner or manager. More specifically, the variable refers to soil and water conservation, avalanche control, sand dune stabilization, desertification control and coastal protection. It does not include forests that have a protective function in terms of biodiversity conservation or those in protected areas, unless the main purpose is soil and water conservation. These forest categories are included in other parts of this report.

Status

Of 233 country reports, 205 provided information on the area of forest with protection of soil and water as the primary designated function in 2010, together accounting for 99.9 percent of the world's forest area. This indicates an improvement in overall country reporting over the last 20 years, given that in 1990 only 186 countries reported on the protective function of forests. In most regions 90 percent or more of countries reported on this variable in 2010. The main exception was the Caribbean region where fewer than half of the countries reported on this variable.

The total extent of forests which are designated for protection of soil and water was estimated in 2010 to be 330 million hectares, equivalent to 8 percent of total forest area (see Table 6.1). Asia has the highest proportion of forests with a protective function (26 percent), followed by Europe (9 percent).

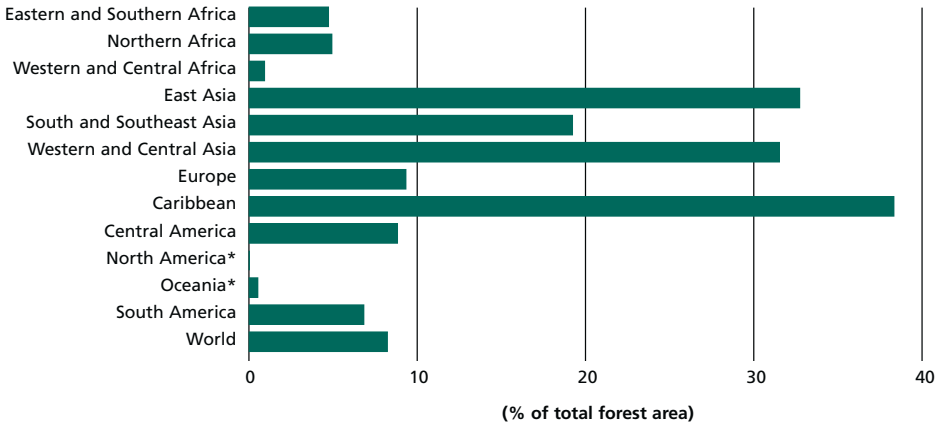
Analysis of the data at the subregional level (Table 6.1 and Figure 6.1) reveals some important differences. The highest proportion of protective forests is reported from the Caribbean region, and these forests are almost entirely located in Cuba (1.36 million

TABLE 6.1
Area of forest designated for protection of soil and water, 2010

Region/subregion	Information availability		Area of forest designated for protection of soil and water	
	Number of countries reporting	% of total forest area	1 000 ha	% of forest area
Eastern and Southern Africa	23	100.0	12 627	4.7
Northern Africa	7	99.1	3 851	4.9
Western and Central Africa	24	100.0	3 079	0.9
Total Africa	**54**	**99.9**	**19 557**	**2.9**
East Asia	5	100.0	83 225	32.7
South and Southeast Asia	17	100.0	56 501	19.2
Western and Central Asia	24	100.0	13 703	31.5
Total Asia	**46**	**100.0**	**153 429**	**25.9**
Total Europe	**46**	**100.0**	**93 229**	**9.3**
Caribbean	12	53.8	1 430	38.3
Central America	7	100.0	1 718	8.8
North America*	5	100.0	0	0
Total North and Central America	**24**	**99.5**	**3 148**	**0.4**
Total Oceania*	**21**	**99.8**	**926**	**0.5**
Total South America	**14**	**100.0**	**58 879**	**6.8**
World	**205**	**99.9**	**329 168**	**8.2**

* See text.

FIGURE 6.1
Proportion of forest area designated for protection of soil and water by subregion, 2010



* See text.

out of 1.43 million hectares). East Asia reported 33 percent protective forests, a large proportion of which (60 million out of 83 million hectares) is accounted for by China. In Western and Central Asia, Georgia, Turkmenistan and Uzbekistan are mainly responsible for the high proportion of forests with a protective function. The Russian Federation accounts for 71 million out of the 93 million hectares of protective forests reported in Europe, and Brazil makes up much of the protective forests in South America (43 million out of 59 million hectares). In Africa, almost half of the protective

forests (8.7 million hectares) are located in Mozambique. Kenya and Sudan also have important areas of protective forests, with 3.3 million hectares in Kenya and 2.4 million hectares in Sudan, out of an African total of 19.6 million hectares. Box 6.1 highlights the important role played by forests in combating desertification in arid zone countries.

BOX 6.1

Arid zone forests: preventing and combating desertification

The increasing number of communities and countries that suffer the negative impacts of land degradation and desertification is a source of huge concern to both the affected countries and the FAO. The desertification process is not merely the advance of existing deserts but rather the combined effect of localized land degradation (usually following deforestation), overexploitation of forests, trees, bush, grazing land and soil resources, and inadequate water resource management. In addition, according to the IPCC, global warming will cause a decrease in rainfall and an increase in extreme weather conditions, such as long periods of drought leading to severe water scarcity and increased desertification.

Sand encroachment, which has devastating environmental and socio-economic impacts, is another desertification challenge. It reduces arable and grazing land, and diminishes the availability of water resources, threatening the productivity of ecosystems and agriculture, as well as the food security and livelihoods of local communities.

The protective functions of forests are more important in arid zones than elsewhere. These lands are more vulnerable to desertification, due to the extremely harsh environmental and socio-economic conditions. Indeed, forests in arid zones have a significant role to play in biodiversity conservation, while providing essential ecosystem goods (such as fodder, wood, medicines and herbs, tradable goods and other NWFPs) as well as services (such as soil stabilization, water conservation, and erosion and desertification control). Their role in climate change mitigation and adaptation is also important, as the sustained provision of these ecosystems' goods and services will help adapt to hardship under a changing climate. However, despite their value, forest ecosystems in arid zones are often caught in a spiral of deforestation, fragmentation, degradation and desertification.

The sustainable management and restoration of arid zone forests is one of the main approaches promoted by FAO and its partners for preventing and combating desertification in the long term. FAO is working with its member countries, experts, research networks and partners to prepare and publish key guidelines to support member countries in their efforts to sustainably manage and rehabilitate arid zone forests. Over the last two years, FAO has facilitated country-driven and regional processes involving a wide range of experts and forestry department representatives in order to the prepare the following key publications:

- *Guidelines on good forestry and range practices in arid and semi-arid zones of the Near East* (FAO Regional Office for the Near East Working Paper – RNEO 1-09);
- *Guidelines on sustainable forest management in drylands of sub-Saharan Africa* (Arid Zone Forests and Forestry Working Paper 1, 2010);
- *Fighting against sand encroachment: lessons from Mauritania* (FAO Forestry Paper 158, 2010).

On the ground, in collaboration with its partners, FAO has implemented a number of field projects. The most recent example is the project 'Acacia Operation: Support to food security, poverty alleviation and control of soil degradation in the gum and resin producing countries'. This project involved six countries (Burkina Faso, Chad, Kenya,

Niger, Senegal and Sudan) and was funded by the Italian Government. The objective of the project was to strengthen the capacity of the six pilot countries to address food security and desertification through the improvement of agrosilvipastoral systems and the sustainable development of the gum and resin sectors. By strengthening local resources, the project focused on improving and sustaining agricultural and pastoral systems, as well as diversifying and increasing household income, thereby contributing to local socio-economic development.

A mechanized water harvesting technology was adopted (Vallerani Technology®), which permits microbasins to be dug while ploughing degraded soils. This aimed to develop Acacia-based agrosilvipastoral systems and reverse land degradation in the six pilot countries. Working with local communities, a total of 13 240 ha were successfully ploughed and planted. An intensive capacity building programme was carried out with local communities on the use and application of the mechanized water harvesting technology, nursery establishment, agricultural production, gum and resin production, tapping and quality control, including post-harvest handling. The pilot phase was successful and efforts are currently underway to secure funding for a ten-year programme, involving eight sub-Saharan countries, to address wider aspects of forest land rehabilitation, livelihoods, market development and climate change mitigation and adaptation.

A total of 86 countries state that they do not have any forest area with 'protection' as the primary designated function. While for certain countries this might in fact be the case (for example countries in Central and Western Asia, such as Oman, Qatar, Saudi Arabia and the Syrian Arab Republic), for other countries – most prominently those in North and Central America, and Oceania – further clarification is necessary.

A very small proportion of forests with protective functions was reported from North and Central America, and Oceania. This is due not to a lack of information in this category, but rather to the fact that these functions are generally embedded in national and local laws and guidance on sound forest management practices. While legislation, regulations and policy may provide guidance on how forest areas must address soil and water conservation, areas with protection as a specific legal designation for their primary function are rare. For example, because soil and water protection are integral considerations in the development of all forest policy and management practices, the United States of America does not report in the category of 'primary function'. Further, the classification of protective function in Oceania is strongly affected by Australia, where the classification system does not directly relate to the designated function classes. Nonetheless, the Australian National Report states that the primary functions of many public native forests in Australia – including those used for timber production – are to protect soil, water and biodiversity.

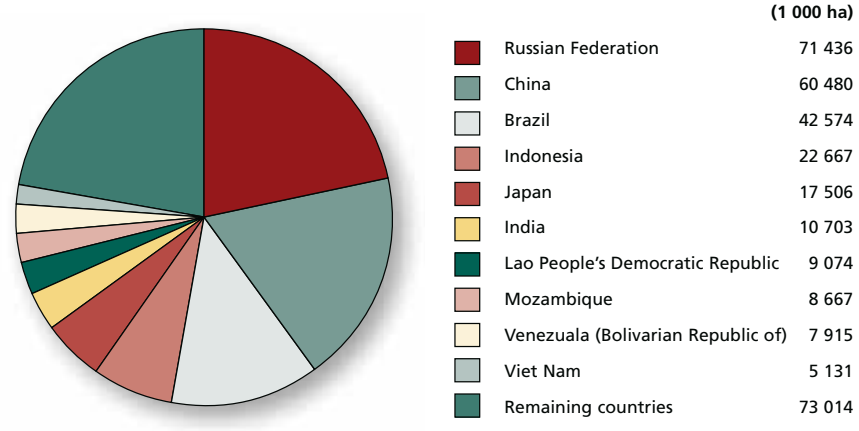
For these reasons, forest areas that are set aside for the purposes of soil and water conservation in these reporting regions are generally included under the primary designated function 'multiple use' in this report. Given these caveats and the fact that the combined forest area of these countries is very large, caution should be used in interpreting the data on the area of forest with 'protection' as the primary designated function in a global context.

Ten countries, mostly in the arid zone, report that 80 percent or more of their total forest area is designated for protective purposes (see Table 6.2). Figure 6.2 shows the ten countries with the largest area of forest designated for protective functions.

TABLE 6.2
Ten countries with the highest proportion of forest area designated for protection of soil and water, 2010

Country/area	Forest area designated for protection of soil and water (%)
Libyan Arab Jamahiriya	100
Bahrain	100
Kuwait	100
Jordan	98
Turkmenistan	97
Kenya	94
Uzbekistan	93
Azerbaijan	92
Wallis and Futuna Islands	87
Iraq	80

FIGURE 6.2
Ten countries with the largest area of forest designated for protection of soil and water, 2010



Trends

The results of the trend analysis, based on the 186 countries that provided information for all four reporting years, show an overall global increase of 59 million hectares in the area of forests with a protective function between 1990 and 2010. Table 6.3 and Figure 6.3 show how the trends vary significantly in the different regions. The positive global trend results mainly from a significant increase in forest area with a protective function in East Asia and Europe. Box 6.2 highlights the increased awareness of the role forests play in conserving water in Europe.

Detailed analysis of the country data results in a varied picture. The most significant increase in the area of forests with a protective function is reported from East Asia. This is mainly the result of large-scale planting in China aimed at desertification control, conservation of soil and water resources and other protective purposes, which more than tripled the area of protective forests between 1990 and 2010. In contrast, Mongolia reported a negative trend in this category.

In Europe the main increase was recorded in the decade between 1990 and 2000. The Russian Federation was largely responsible for this increase, where area of forest

TABLE 6.3
Trends in area of forest designated for protection of soil and water by region and subregion, 1990–2010

Region/ subregion	Information availability		Area of forest designated for protection of soil and water (1 000 ha)				Annual change (1 000 ha)		Annual change rate (%)	
	Number of countries	% of total forest area	1990	2000	2005	2010	1990–2000	2000–2010	1990–2000	2000–2010
Eastern and Southern Africa	21	80.9	14 003	13 311	12 950	12 611	-69	-70	-0.51	-0.54
Northern Africa	7	99.1	4 068	3 855	3 842	3 851	-21	0	-0.54	-0.01
Western and Central Africa	22	52.5	2 639	3 281	3 236	3 079	64	-20	2.20	-0.63
Total Africa	**50**	**69.2**	**20 709**	**20 447**	**20 027**	**19 540**	**-26**	**-91**	**-0.13**	**-0.45**
East Asia	4	90.2	24 061	38 514	58 336	65 719	1 445	2 721	4.82	5.49
South and Southeast Asia	17	100.0	55 811	57 932	59 389	56 501	212	-143	0.37	-0.25
Western and Central Asia	23	99.7	12 222	13 059	13 553	13 669	84	61	0.66	0.46
Total Asia	**44**	**95.8**	**92 094**	**109 505**	**131 278**	**135 889**	**1 741**	**2 638**	**1.75**	**2.18**
Total Europe	**45**	**99.7**	**76 932**	**90 788**	**91 671**	**92 995**	**1 386**	**221**	**1.67**	**0.24**
Caribbean	11	53.1	869	1 106	1 327	1 428	24	32	2.44	2.58
Central America	3	36.9	124	114	102	90	-1	-2	-0.90	-2.33
North America*	5	100.0	0	0	0	0	0	0	–	–
Total North and Central America	**19**	**97.8**	**994**	**1 220**	**1 429**	**1 517**	**23**	**30**	**2.07**	**2.21**
Total Oceania*	**18**	**21.6**	**1 048**	**1 078**	**1 087**	**888**	**3**	**-19**	**0.28**	**-1.92**
Total South America	**10**	**85.1**	**48 656**	**48 661**	**48 542**	**48 549**	**1**	**-11**	**n.s.**	**-0.02**
World	**186**	**86.9**	**240 433**	**271 699**	**294 034**	**299 378**	**3 127**	**2 768**	**1.23**	**0.97**

* See text.

with a protective function increased from 59 million hectares in 1990 to over 70 million hectares in 2000.

In Africa the forest area with a protective function decreased somewhat. The country information shows that the negative trend in Eastern and Southern Africa results from a decrease in forest with a protective function in the three most important countries in this category (Kenya, Mozambique and Zimbabwe).

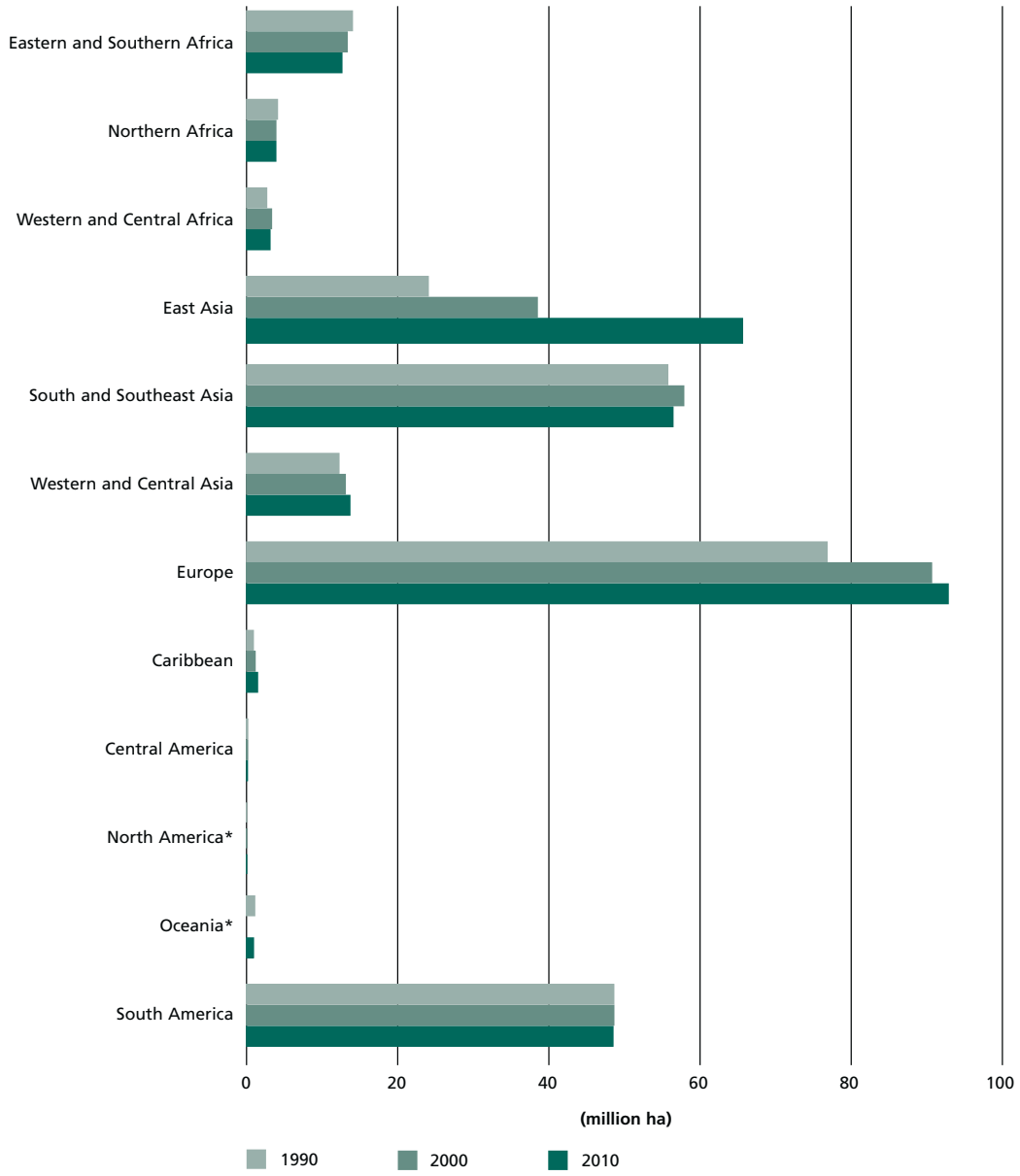
In South and Southeast Asia the forest area with a protective function increased during the decade from 1990 to 2000 and then decreased again from 2000 to 2010. The situation is quite heterogeneous in this region. A steady increase in forest cover with a protective function was reported for example by Bhutan, India, the Philippines and Thailand, but the opposite trend was registered in Bangladesh, Indonesia, Lao People's Democratic Republic, Nepal and Timor-Leste. Finally, in some countries such as Malaysia, Myanmar and Viet Nam, the forest area in this category increased between 1990 and 2000 and decreased again from 2000 to 2010.

The very low figures reported for North and Central America and Oceania are the result of differences in how soil and water protection is legislatively mandated in Canada, Mexico, the United States of America and Australia (see earlier discussion). In South America the area of forest with a protective function has remained relatively stable.

Conclusions

Around 330 million hectares of forest are designated for soil and water conservation, avalanche control, sand dune stabilization, desertification control or coastal protection.

FIGURE 6.3
Trends in area of forest designated for protection of soil and water by subregion, 1990–2010



* See text.

This area increased by 59 million hectares between 1990 and 2010 and now accounts for eight percent of the global forest area. The recent increase is primarily due to large-scale planting in China for protective purposes.

In view of the many protective functions of forests and their increasing importance, there is a growing imperative for countries to gather, analyse and present information on the extent and condition of forests with a protective function.

The analysis of data supplied for FRA 2010 highlights significant regional differences in reporting on the area of forest with a protective function and there is a clear need to harmonize and clarify the criteria for reporting under this category for FRA 2015.

BOX 6.2

Generating momentum on forests and water in Europe

Forests influence water availability and regulate surface and groundwater flows, while maintaining high water quality. Forested watersheds supply a high proportion of the water for domestic, agricultural, industrial and ecological needs in both upstream and downstream areas. The availability and quality of water in many regions of the world is increasingly threatened by overuse, misuse, pollution and the projected negative impacts of climate change. A key challenge faced by land, forest and water managers is to maximize the wide range of forest benefits without detriment to water resources and ecosystem functions, particularly in the context of adaptation to climate change, which increasingly reinforces the importance of sustainable forest management. To address this challenge, enhanced synergy is needed between the water and forest communities, through institutional mechanisms aimed at implementing programmes of actions at national and regional levels. Similarly, there is an urgent need for an even greater understanding of the interactions between forests and water, and for embedding the research findings into policy agendas.

Over the past few years, the interactions between forests and water have received increasing attention in Europe. The Warsaw Resolution 2 "Forests and Water" of Forests Europe (the former Ministerial Conference on the Protection of Forests in Europe) was a milestone in triggering this significant international momentum. The Resolution was adopted on the occasion of the Fifth Ministerial Conference held in Warsaw, Poland, from 5 to 7 November 2007. Recognizing the close interrelation between forests and water, the signatory states and the European Community committed themselves to undertaking consistent action in order to address four main areas of concern:

- sustainable management of forests in relation to water;
- coordinating policies on forests and water;
- forests, water and climate change;
- economic valuation of water-related forest services.

As part of the follow-up to the endorsement of Warsaw Resolution 2, a number of important events were organized on this topic in Europe between 2008 and 2010:

- the 26th session of the European Forestry Commission's Working Party on the Management of Mountain Watersheds, 19–22 August 2008, in Oulu, Finland, with the seminar topic "Forest, Water and Climate Change in High Altitude and High Latitude Watersheds";
- the III International Conference on Forests and Water, 14–17 September 2008, in Mragowo, Poland;
- the plenary session on forests and water held during European Forest Week, 20–24 October 2008, at FAO Headquarters, Rome, Italy;
- the international conference "Water and Forest: a Convenient Truth?", 30–31 October 2008, in Barcelona, Spain;
- the Workshop on Forests and Water, held within the work programme of Forest Europe, 12–14 May 2009, in Antalya, Turkey;
- the forests and water sessions and side event, 18–25 October 2009, at the XIII World Forestry Congress in Buenos Aires, Argentina;
- the plenary session on forests and water held during the 35th session of the European Forestry Commission, 27–30 April 2010, in Lisbon, Portugal.

Each of these events was organized by a different stakeholder group and discussed the 'forests and water' topic from a slightly different perspective. As a result, the harvest of conclusions and recommendations from these consultations is very rich. The events highlighted the gaps and misconceptions that still persist and the need to translate scientific knowledge into tools that can be used by policy-makers; the need to create national and transboundary institutions able to bring together all actors; and the need to share between countries the existing experiences related to joint forest and water management. In close collaboration with the key partner institutions that were the drivers of these events, FAO is synthesizing the recommendations resulting from this process in order to plan future actions and develop a relevant and practical international forests and water agenda.

Sources: FAO (2010b); EFC (2010)

Chapter 7

Socio-economic functions of forest resources

OVERVIEW

Forest provide a wide variety of social and economic benefits, ranging from easily quantified economic values associated with forest products, to less tangible services and contributions to society. In order to measure progress towards the implementation of sustainable forest management, it is necessary to monitor changes in the outputs provided by forest management in social and economic, as well as environmental, dimensions. This chapter presents statistics about the economic and social benefits of forest management, as well as information about the ways in which forests are managed from a social and economic perspective.

The economic benefits of forest management can be calculated directly as the quantity of outputs (products and services) produced by forests, each multiplied by an appropriate value then added together. For many outputs, market prices can be used as an estimate of value. However, it is more difficult to estimate values for subsistence uses of forest products or for outputs that are not bought and sold in markets.

The social benefits of forests are much more difficult to measure because the amount and value of these contributions to society are both difficult to quantify. In this case, indirect measures are often used to allow trends to be quantified and monitored over time.

This chapter starts by describing two ways in which forest management is changing. First, recent trends in forest ownership and management rights are described. Second, the fiscal measures that governments use to provide support to forest management and collect fees and charges from the sector are outlined. This information is important in understanding the changing roles of government and citizens in the sector. It then presents the current status and trends for an indicator of the economic benefits of forestry – the value of wood and NWFP removals; and two social indicators – employment in forestry and the area of forests designated for social services (an indirect measure of social benefits).

Information was collected from all countries on ownership and management rights of forests by local communities, and the formal employment opportunities offered by forests. To complement this, a special study is underway to highlight the links between forests, poverty and livelihoods. A short summary of this study is provided in Box 7.1.

KEY FINDINGS

Eighty percent of the world's forests are publicly owned, but ownership and management of forests by communities, individuals and private companies is on the rise

Despite changes in forest ownership and tenure in some regions, most of the world's forests remain under public ownership. Differences among regions are considerable. North and Central America, Europe (other than the Russian Federation), South America and Oceania have a higher proportion of private ownership than other regions. In some regions, there is an increasing trend towards the involvement of communities, individuals and private companies in the management of publicly owned forests.

BOX 7.1

FRA 2010 special study on forestry, poverty and livelihoods

There is increasing interest in the role that forests play in supporting the poor, in reducing their vulnerability to economic and environmental shocks, and in reducing poverty. However, the contribution that forests actually make to poverty reduction and increasing the livelihood resilience of the poor is often obscure for policy-makers in key ministries, including finance, planning and local government, and the supra-ministerial bodies where poverty reduction strategy processes are often located. There is a tendency to underestimate the contribution of forests – and off-farm natural resources in general – to livelihoods, and the role of forests in poverty reduction has so far not been reflected in any significant way in national level strategy in most countries.

On the forestry side, reporting has typically been focused on the physical resource and its status and extent. Such reporting sheds no light on the contributions made by forests to the lives of the poor. Ministries responsible for forestry have only moved very slowly towards collecting new kinds of data to meet this challenge. Their previous experience has not prepared them for this task and they need to be supported to deal effectively with the new requirements.

To address this issue FAO is developing ways of collecting and incorporating data about the reliance of local people on forests, and the value of those forests to them, into future Global Forest Resource Assessments. It will become essential for countries to learn how to assess this aspect of the value of forests, which will greatly increase the visibility and profile of the sector in poverty reduction.

In partnership with IUCN, the Center for International Forestry Research and the Program on Forests of the World Bank, FAO will undertake a pilot study to test methods in three countries: Uganda (Africa), Viet Nam (Southeast Asia) and a third country in Central America (possibly Guatemala). Field work in the three countries will help establish a baseline from which the contribution of forests to livelihood resilience and poverty reduction can be derived. The field work will use the most recent census in each country and apply agreed wealth or poverty criteria to all villages in all districts where forests exist. A more detailed assessment will then be undertaken in a sample of villages throughout the country. Finally, guidance will be provided to governments on ways of establishing low cost data collection methods that illuminate the value of forests to local livelihoods and poverty reduction.

By June 2011 the study is expected to provide an assessment of the reliance of local people on forests and the value of forests to them; and a rough national level picture of the links between poverty and forests, extrapolated from village-level studies.

Governments generally spend more on forestry than they collect in revenue

On average, total forest revenue collection was about US$4.5 per hectare, ranging from under US$1 per hectare in Africa to just over US$6 per hectare in Europe. Public expenditure on forestry was about US$7.5 per hectare on average. Average expenditure was highest in Asia (over US$20 per hectare). In contrast, the average expenditure per hectare was less than US$1 in South America and Oceania.

The value of wood removals is high, but fluctuating

Wood removals were valued at just over US$100 billion annually in the period 2003–2007. Industrial roundwood accounted for most of this value. At the global level the reported value of wood removals showed no change between 1990 and 2000, but increased by about 5 percent annually over the period 2000–2005. This suggests that roundwood prices recovered somewhat from their decline (in real terms) in the decade 1990–2000. However, since 2005 they have fallen sharply.

The value of NWFPs remains underestimated

The reported value of NWFP removals amounts to about US$18.5 billion for 2005. Food products account for the greatest share of this. However, information is still missing from many countries where NWFPs are highly important, and the true value of subsistence use is rarely captured. As a result, the reported statistics probably cover only a fraction of the true total value of harvested NWFPs.

Around 10 million people are employed in forest management and conservation – but many more are directly dependent on forests for their livelihoods

Reported employment in forest establishment, management and use declined by about 10 percent between 1990 and 2005, probably because of gains in labour productivity. Europe, East Asia and North America saw steep declines (15 to 40 percent between 1990 and 2005), while in other regions, employment increased somewhat – probably because roundwood production has increased faster than gains in labour productivity. Most countries reported increased employment in the management of protected areas. Given that much forestry employment is outside the formal sector, forest work is certainly much more important for rural livelihoods and national economies than the reported figures suggest.

The management of forests for social and cultural functions is increasing, but the area is difficult to quantify

Globally, 4 percent of the world's forests are designated for the provision of social services. East Asia and Europe are the only regions with fairly good data on the designation of forests for recreation, tourism, education or conservation of cultural and spiritual heritage. In these two regions, provision of social services was reported as the primary management objective for 3 percent (East Asia) and 2 percent (Europe) of the total forest area. Brazil has designated more than one-fifth of its forest area for the protection of the culture and way of life of forest-dependent peoples.

KEY CONCLUSIONS

The poor availability of data makes it very difficult to draw any conclusions about increasing or decreasing trends in the importance of forests' socio-economic functions. However, it appears that the main economic benefits of forests (employment and value of outputs) may be static or declining, while the social and cultural benefits could be increasing. This very broad shift towards non-market outputs of forests seems to concur with national and international policy debates about forests and forestry, where social and environmental aspects are always very high on the agenda. It is also consistent with the information collected about forest ownership and government involvement in the sector, which shows a gradual shift towards less public ownership in most countries and regions and slightly more net public expenditure on forestry.

It will always be difficult to quantify and collect information about social and environmental functions, but they represent some of the main outputs from forests and it is recommended that the FRA process should continue to collect this information in future.

OWNERSHIP AND MANAGEMENT RIGHTS

Introduction

Since 2005, information about forest ownership and management rights (or forest tenure) has been included in the FRA as one indicator of the socio-economic functions of forests. Compared with the previous assessment, FRA 2010 includes more information about different types of private ownership (e.g. individual, corporate and community/indigenous) as well as new information about who manages public forests.

This expanded dataset significantly improves the quality and the usefulness of the information collected.[22]

It is commonly assumed that 'secure tenure' enables or provides incentives for people to invest time and resources in forest management (FAO, 2006e, 2008b, 2009c; Sunderlin, Hatcher and Liddle, 2008). Access to data on forest tenure (including changes and trends) is therefore a fundamental prerequisite for any country in designing and adopting effective and secure tenure arrangements that can help to reduce deforestation and forest degradation. This is especially true where changes in resource tenure patterns are increasing the complexity of relationships between stakeholders.

Status

Of the 233 countries and areas covered by FRA 2010, 188 reported on forest ownership for 2005 in the main categories (public, private and other). These 188 countries accounted for 99 percent of the total forest area (compared with 77 percent in FRA 2005).

In 2005, 80 percent of the global forest area was publicly owned, 18 percent was privately owned and 2 percent was classified as 'other' ownership, including unknown and disputed ownership (Table 7.1).

Public ownership was predominant in all regions and subregions. Europe excluding the Russian Federation was the exception to this, where public ownership accounted for less than half (46 percent) of the forest area[23] (see Figure 7.1). Public ownership was also by far the most common form of ownership in many of the countries with high forest cover, such as Brazil, Democratic Republic of the Congo, Indonesia and the Russian Federation. Private ownership was more common in North America (31 percent), Central America (46 percent) and Oceania (37 percent). It was also significant in South America (21 percent) and East Asia (33 percent), due to high levels of private ownership in a few countries such as Chile, Colombia, Paraguay and China.

Figure 7.2 shows private forest ownership by type of forest owner in 2005. Far fewer countries reported this information, with reporting countries covering 55 percent of the forest area globally and only 16 percent in Asia (the region with the lowest rate of response). Fewer countries also reported forest ownership for the entire time series (1990–2000–2005).

TABLE 7.1
Forest ownership by region, 2005

Region	Information availability		Forest area by ownership					
	Number of countries reporting	% of total forest area	Public		Private		Other	
			1 000 ha	%	1 000 ha	%	1 000 ha	%
Africa	49	97.0	634 571	94.6	25 710	3.8	10 487	1.6
Asia	46	100.0	475 879	81.5	107 520	18.4	640	0.1
Europe	45	100.0	897 463	89.6	101 817	10.2	1 847	0.2
North and Central America	22	99.4	432 307	61.7	222 799	31.8	46 040	6.6
Oceania	13	99.7	121 316	61.9	72 677	37.1	2 088	1.1
South America	13	96.5	641 505	75.3	180 602	21.2	29 552	3.5
World	**188**	**98.6**	**3 203 040**	**80.0**	**711 125**	**17.8**	**90 654**	**2.3**

[22] It should be noted that this data refers to the ownership of forests and trees rather than the ownership of forest.

[23] Including the Russian Federation in Europe, public ownership was almost 90 percent, because all forest in the Russian Federation is publicly owned.

FIGURE 7.1
Forest ownership by subregion, 2005

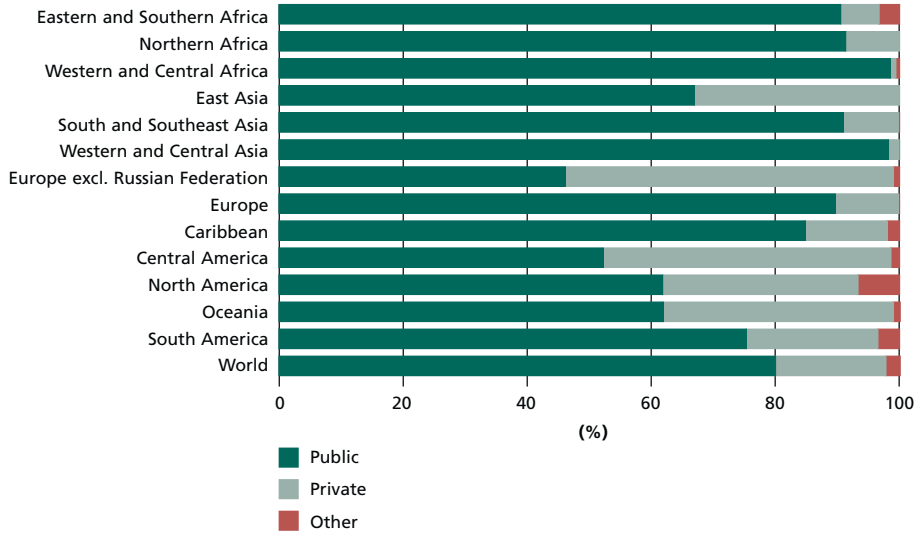
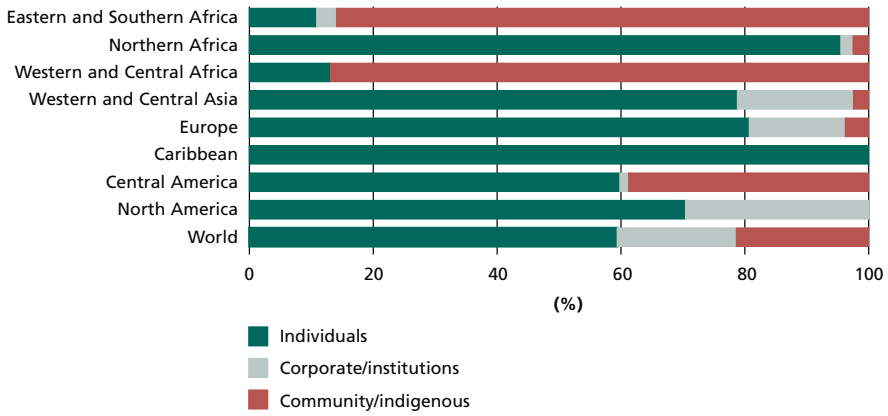


FIGURE 7.2
Private forest ownership by type of forest owner and subregion, 2005



Note: This figure only includes subregions where information covered more than 25 percent of the total forest area.

This limited information gives only an imprecise indication of private forest ownership at the global and regional levels. However, the countries reporting this information indicated that 59 percent of private forests were owned by individuals, 19 percent by private corporations and institutions, and the remaining 21 percent by local communities and indigenous people. At the regional level, individual ownership was dominant in most regions and corporate ownership was also significant in North America, Europe (excluding the Russian Federation) and Western and Central Asia.

Communities and indigenous people owned the majority of private forests in sub-Saharan Africa, although this is insignificant in terms of total forest area (around one percent of the total area), because almost all forest in these countries is owned by the state. Communities and indigenous people also owned a significant share of private

forests (and total forest area) in Central America as a whole (44 percent) because of the situation in a few countries such as Guatemala and Honduras.[24]

Publicly owned forests may be managed by the state, communities, individuals or the private sector. Figure 7.3 shows who was responsible for management of public forests at the global and subregional levels. This information was reported by 152 countries (accounting for 92 percent of total forest area) for 2005 and 130 countries (80 percent of total forest area) reported the entire time series. These figures therefore give a fairly good, albeit partial, picture of who manages public forests across the world.

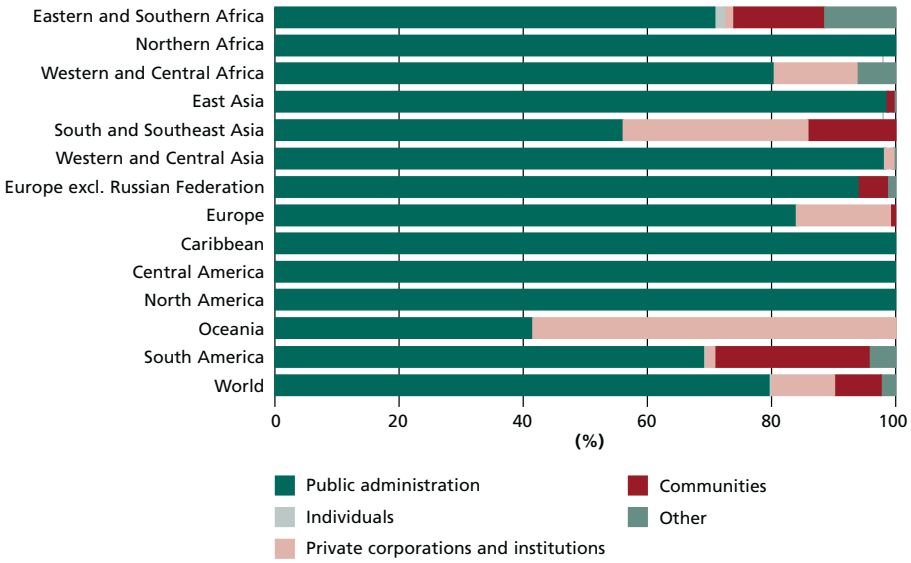
At the global level, the state retains management responsibilities in about 80 percent of public forests, followed by private corporations and institutions (10 percent), and communities (7 percent). Private corporations and institutions were particularly important in a few regions and subregions, such as Oceania, South and Southeast Asia and Western and Central Africa, because of their large influence in countries such as Australia, Indonesia and those of the Congo Basin. In these regions and subregions, private companies were responsible for forest management in 58, 30 and 14 percent of public forests respectively.

In South America, private corporations and institutions did not manage much public forest, although this is expected to increase in the future as a result of the forest concession law introduced in 2006 in Brazil. However, community management of public forests was very common in South America (e.g. in Brazil) and in South and Southeast Asia (e.g. in India and the Philippines).

Trends

At the global level, the area of forest under public ownership decreased by 141 million hectares, or about 0.3 percent annually between 1990 and 2005, while the area of forest under private ownership increased by 113 million hectares or almost 1.5 percent per

FIGURE 7.3
Management of public forests by subregion, 2005



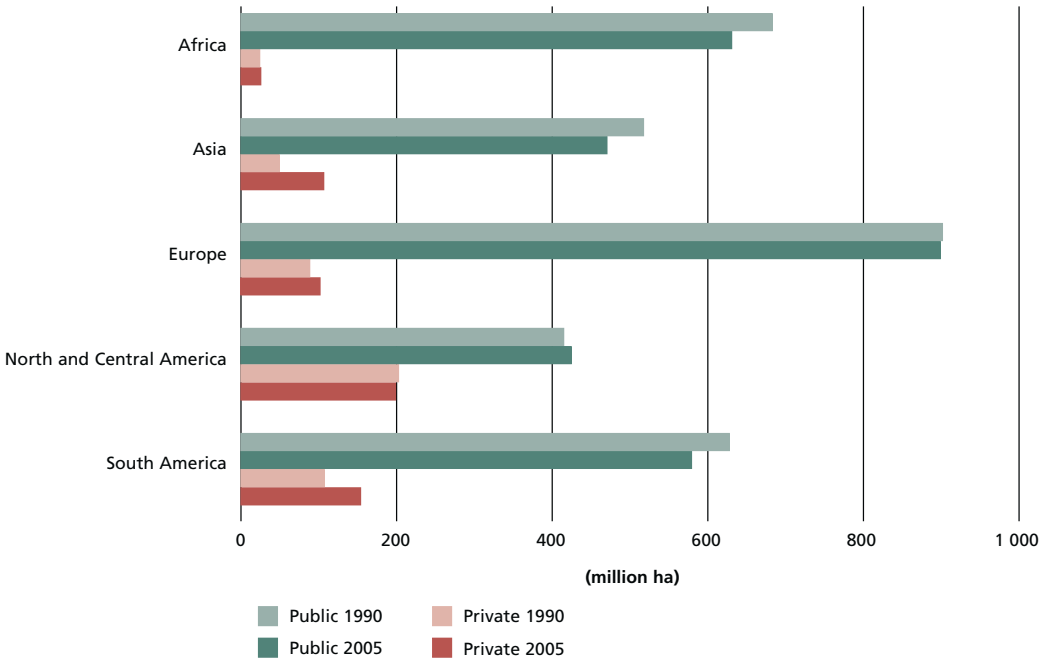
[24] It should also be noted that 70 percent of forests in Mexico are owned by 'ejidos' (local communities), but this is not shown here because these were classified as 'other forms of ownership'.

year on average. It is likely that the increase in privately owned forests mostly occurred in planted forests rather than natural forest as this is the main means of acquiring private forest ownership in many countries. It is not possible to say how much of the reduction in the area of publicly owned forests is due to changes in ownership itself or to a reduction of the total forest area but the latter seems more likely in many cases. However, the area of privately owned forests has increased over the past 15 years in both Asia and South America as a result of significant increases in countries such as China and Colombia. In contrast, it only increased very slightly in Africa and declined in North and Central America (see Figure 7.4). The reason for the decline of privately owned forests in North America is a move towards more public ownership of forests in the United States of America in line with long term restoration and conservation strategies.

Due to the lack of data, it is not possible to examine trends in the different types of private ownership over time, but it is possible to show the changes in the management of public forests over the last 15 years (see Figure 7.5).

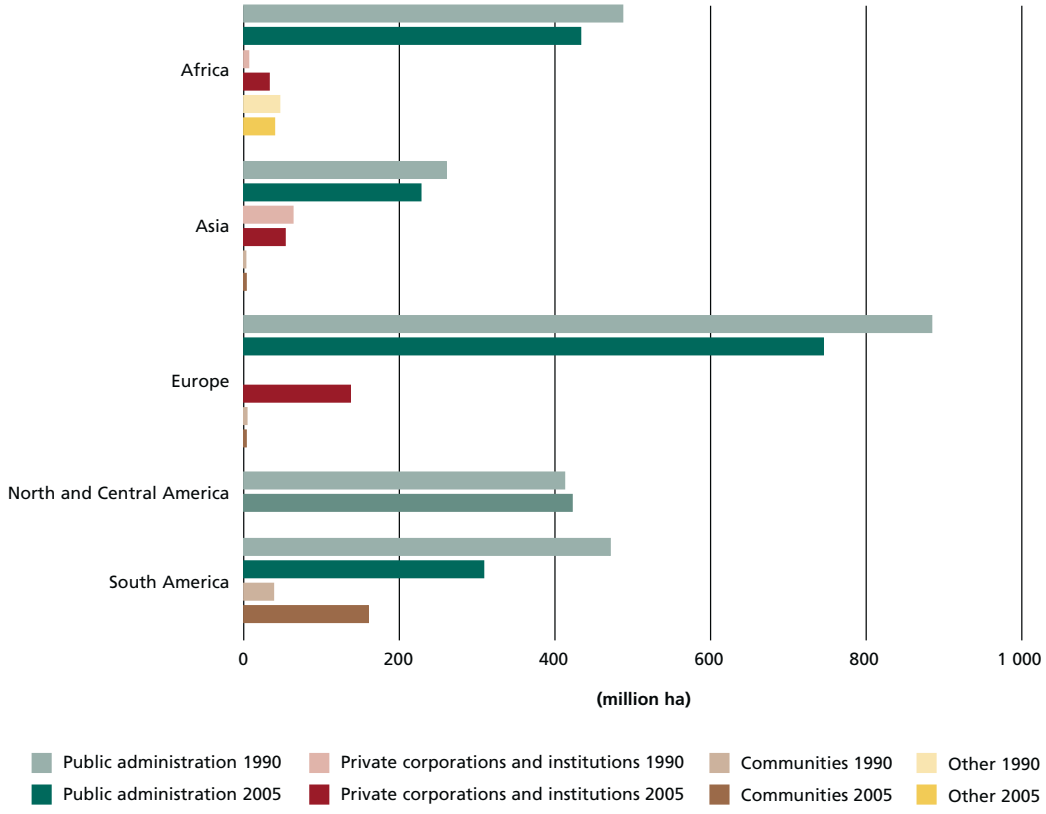
A reduction in state forest management and an increase in private sector management were seen in Europe (largely because of the Russian Federation, where private sector management increased from zero in 1990 to 137 million hectares in 2005) and in Africa. A shift from state management to management by local communities occurred in South America. Less evident are the change rates in Asia: both state and corporate management have decreased, but this appears to be linked to a reduction in the forest area of the reporting countries (data were missing from China) rather than a greater role for local communities in managing the public forests. Finally, although the role of local communities has increased in percentage terms in Africa, the area of public forest managed by local communities is still very small in this region.

FIGURE 7.4
Trends in public and private ownership of forests by region, 1990–2005



Note: Oceania not shown due to low level of information availability

FIGURE 7.5
Trends in management of public forests by region, 1990–2005



Note: Oceania is not shown because of a low level of data availability.

Conclusions

The increased number of reporting countries compared to FRA 2005 is encouraging and might indicate that countries are becoming more aware of the importance of gathering forest tenure data as a basis for the development and implementation of policy and legislation.

Public ownership remains the predominant ownership category in all regions and at the global level, although the area of forest under public ownership has declined in the past 15 years. The most notable changes at the regional level are the increased devolution of management responsibilities from the state to the private sector – especially in Central Africa and the Russian Federation – and to local communities in South America and Southeast Asia. Furthermore, it is expected that major shifts in forest ownership and management will continue as a consequence of forest tenure reform in China (in favour of private ownership by individuals and families) and possibly in Latin America (with the growing role of the private sector in Brazil). In Africa, the role of the state remains dominant with some management rights devolved to private corporations in the high forest cover countries of Central Africa and to communities in Eastern and Southern Africa.

PUBLIC EXPENDITURE AND REVENUE COLLECTION

Introduction

Public expenditure and revenue collection from forestry are measures of the financial flows between government and the forestry sector. In FRA 2010 forest revenue was defined to include all taxes, fees, charges and royalties collected specifically from the domestic production and trade of forest products, but it excluded general taxes collected from all sectors of the economy (e.g. corporation tax and sales tax). Public expenditure included expenditure on forestry activities by all relevant public institutions and was divided into operational expenditure and transfer payments[25], with each of these types of expenditure divided by source of funding (domestic or external). Countries were also asked to exclude the income and expenditure of publicly-owned businesses in their reports (FAO, 2007h).

Forest revenue can be interpreted in two ways, depending on the arrangements for forest management in a country. In countries where large areas of forest are owned or managed by the state and are used for commercial production, forest revenue can be an indicator of the economic benefit of forest management (i.e. the income, rent or profit to the state as forest owner). A more general interpretation is that forest revenue is an indicator of the contribution of forestry activities to public finances. This is a broader indicator of the economic benefit of the sector as a whole, which is particularly useful when it is compared to public expenditure to show the net financial flow between government and the forestry sector. Data on forest revenue may indicate how the economic benefits of forestry change over time, but comparisons between countries should be interpreted carefully because forest revenue can be affected by numerous factors, such as the actual or potential market value of forest resources, forest management objectives and the ability of governments to collect revenue (FAO, 2003).

Public expenditure on forestry is a partial indicator of the level of government influence over forestry activities in a country. In broad terms, governments have four different sets of instruments to implement public policies: regulations; fiscal policies (e.g. transfer payments and tax regimes); direct action (e.g. public expenditure directly on forest management); and activities to facilitate or encourage changes in behaviour (e.g. awareness raising activities). With the exception of preferential tax treatment and, to some extent, direct action[26], the information collected about public expenditure indicates how much governments spend on the different types of instruments listed above.

The division of this information into operational expenditure and transfer payments gives a very rough indication of the relative emphasis given to regulation and facilitation (operational expenditure) and transfer payments. Furthermore, it is likely that expenditure on regulation is much higher than expenditure on facilitation, so this information gives a broad indication of how much governments try to restrict behaviour (i.e. through regulations) as opposed to their efforts to try to encourage certain types of behaviour through financial incentives (i.e. transfer payments).

The information about the sources of funding for public expenditure gives an indication of the reliance of countries on foreign assistance for the implementation of their forestry policies, programmes and projects. The total amount of funding from

[25] Transfer payments are payments by government to support forestry activities by non-state individuals, companies and institutions. These include, for example, grants for afforestation and forest management, and subsidies for employment, tools and materials.

[26] The extent to which expenditure on direct action is included in the data collected for FRA 2010 depends on whether countries implement such actions through government-owned business entities (e.g. state forest enterprises) or more directly through the forest administration (e.g. civil service). The intention in FRA 2010 was to exclude income and expenditure on direct action from the data supplied by countries, but it was not easy to describe this in the definitions used for FRA 2010 and it is likely that some countries have included such expenditure in their replies.

external sources gives a partial indication of the amount of development assistance for forestry. However, it only includes funding that is provided to governments. It does not include assistance in-kind and development assistance that is provided through non-governmental institutions. Therefore, it is an underestimate of total foreign assistance to the sector.

As noted above, this information is only a partial indicator of the investments and returns to forest management in a country, but it is a slightly better indicator of the amount of government intervention in the sector and the main instruments that governments use to try to influence forestry activities. Thus, it provides useful information about some of the economic aspects of governments' progress towards sustainable forest management and it should be interpreted in this context rather than as a measure of the outputs from the sector.

Status

Estimates of forest revenue and public expenditure were collected for the years 2000 and 2005 and the figures for 2005 are shown in Table 7.2 and Table 7.3, while Figure 7.6 and Figure 7.7 show forest revenue and public expenditure per hectare of forest by country. Over 100 countries supplied this information, with countries reporting revenue collection accounting for 79 percent of the global forest area and those reporting expenditure accounting for 64 percent of the area. Thus, the figures present only a partial estimate of global revenue collection and expenditure on forestry, but the reporting countries account for a significant share of global forest resources. The countries with significant forest areas that were unable to supply some of this information included Australia, Canada, Democratic Republic of the Congo, Finland, France, Germany, Indonesia and New Zealand, but many of these provided at least partial information.

Total forest revenue collection in 2005 was US$14.6 billion, which is equivalent to about US$4.60 per hectare or US$6.10 per cubic metre of wood production.[27] Revenue collection in the different regions was roughly in proportion to their forest areas, resulting in similar figures for revenue collection per hectare in each region. The one major exception was Africa, where revenue collection was very low at

TABLE 7.2
Forest revenue collection by region, 2005

Region	Information availability		Forest revenue in 2005					
	Number of countries	% of total forest area	Total		Revenue per ha (US$)		Revenue per m³ (US$)	
			Million US$	%	All areas	Public area	All removals	Adjusted[2]
Africa	31	63	285	2	1	1	1.24	6.85
Asia	22	88	2 846	19	5	7	4.31	18.92
Europe	20	89	5 420	37	6	6	13.39	17.72
North and Central America[1]	14	90	2 620	18	4	6	3.40	5.56
Oceania	7	20	146	1	4	23	5.33	33.24
South America	7	76	3 290	23	5	6	10.80	26.50
World	**101**	**79**	**14 607**	**100**	**5**	**6**	**6.09**	**12.34**

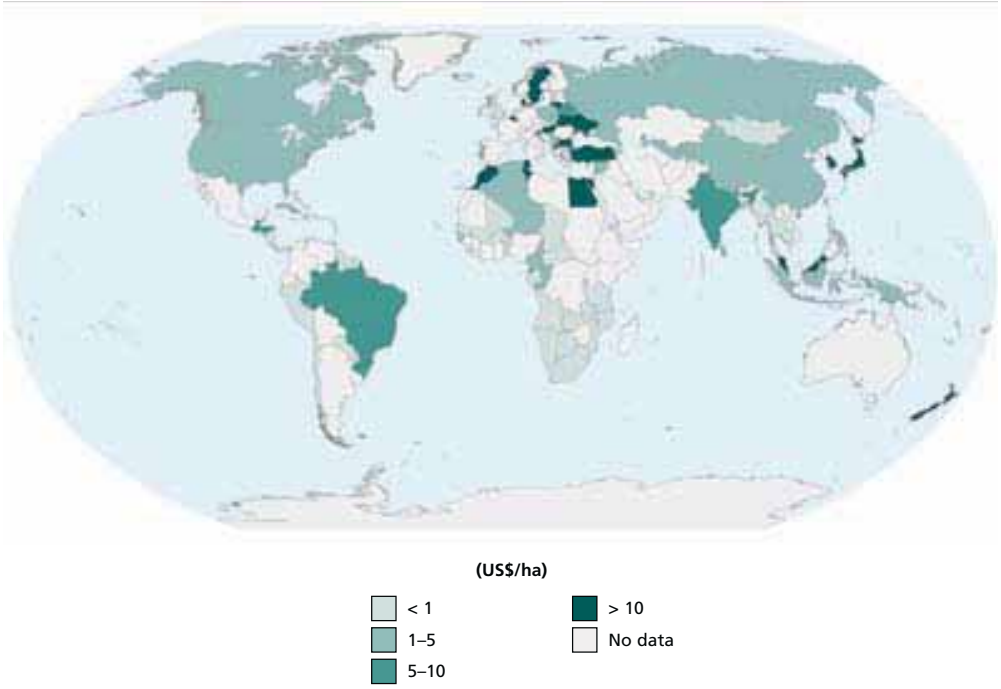
Notes:
[1] These figures use revenue figures for 2000 for the United States of America (2005 not available).
[2] Excludes fuelwood production and production from private forests (based on share of total forest area).

[27] All figures per hectare and per cubic metre were calculated by dividing total revenue or expenditure by the area of forest or amount of production in those countries reporting revenue or expenditure.

TABLE 7.3
Public expenditure on forestry by region, 2005

Region	Information availability		Public expenditure on forestry in 2005			
	Number of countries	% of total forest area	Total		Expenditure per ha (US$)	
			Million US$	%	All area	Public area
Africa	26	46	625	3	2.04	2.15
Asia	22	51	6 766	36	22.46	30.09
Europe	28	94	5 137	27	5.45	5.85
North and Central America	13	55	6 303	33	16.28	43.96
Oceania	6	16	15	0	0.51	16.21
South America	8	73	166	1	0.26	0.35
World	**103**	**64**	**19 012**	**100**	**7.31**	**9.47**

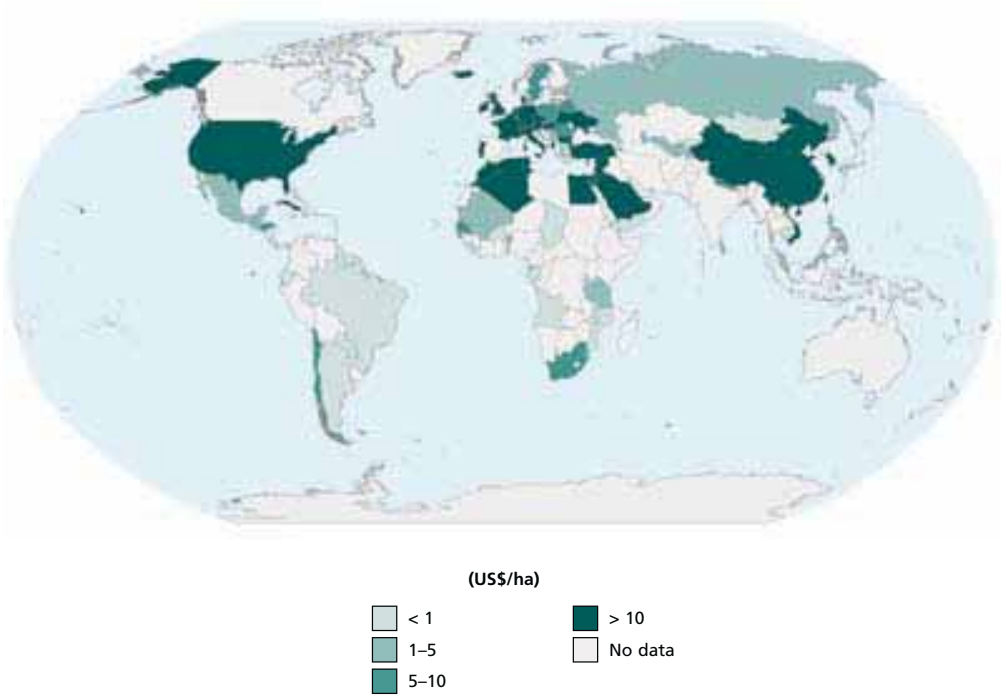
FIGURE 7.6
Forest revenue collection by country, 2005



only US$285 million in total or US$0.67 per hectare on average. Furthermore, three countries (Cameroon, Morocco and the Republic of the Congo) accounted for about two-thirds of reported revenue collection in Africa, indicating that revenue collection in the other reporting countries is extremely low.

If it is assumed that most forest revenue is collected from the use of state-owned forest resources, then the global average for revenue collection per hectare is slightly higher at US$5.60. The one region where this figure was much higher is Oceania. This is because in Papua New Guinea the government collects a significant amount of forest revenue but most of the forest is owned by traditional landowners. Similarly, revenue collection per cubic metre of wood production is higher if fuelwood production is excluded and it is assumed that this is mostly collected from production in state-

FIGURE 7.7
Public expenditure on forestry by country, 2005



owned forests. However, these figures (shown in the last column of Table 7.2) are very imprecise, because the exact amount of production from state-owned forests was not collected in FRA 2010.

Total public expenditure on forestry in 2005 was just over US$19 billion, with most of this expenditure in Asia, Europe and North and Central America. Average expenditure per hectare was US$7.31, but expenditure per hectare was much higher in Asia and North and Central America. The figure for Europe was lower than the global average due to the inclusion of the Russian Federation in this region (which has a vast forest area and relatively low expenditure per hectare). Excluding the Russian Federation, expenditure per hectare in the rest of Europe would be very high (US$30.95 per hectare).

Public expenditure on forestry in Africa was relatively low, but expenditures in Oceania (US$0.51 per hectare) and South America (US$0.26 per hectare) were even lower. These low figures were caused by the dominance of Papua New Guinea and Brazil in the calculation of the regional averages, as both countries have comparatively large forest areas resulting in very low expenditure per hectare. In the case of Papua New Guinea the low figures per hectare may also be explained by the fact that most of the forest area is under private (communal) ownership.

Again, if it is assumed that the majority of public expenditure is devoted to the management of state-owned forests, then total expenditure divided by the area of forests in public ownership results in a higher estimate of expenditure per hectare (with a global average of US$9.47 per hectare). However, some of this expenditure is used to support forestry in the private sector or to fund administration and other regulatory activities, so this is not a very reliable estimate of investment in forest management in state-owned forests.

Table 7.4 shows the sources of funding (domestic and external) and the uses of public expenditure on forestry in 2005. As the table shows, the majority of public expenditure on forestry came from domestic sources and the amount of external funding was only US$699 million, or about 4 percent of the total. As might be expected, Africa had the highest contribution of external funding to public expenditure on forestry at US$175 million (28 percent of the total). Europe also had a relatively high proportion of external funding. This is because some public expenditure on forestry in member states of the European Union comes from common funds administered by the European Commission.

The distribution of expenditure between operational expenditure and transfer payments was very variable between regions, with transfer payments accounting for about 43 percent of all expenditure at the global level. Transfer payments were comparatively high in Asia, Europe and South America, but much lower in the other three regions. This is probably partly due to expenditure on support for establishment of planted forests as well the higher levels of private forest ownership in many countries in these regions.

All the data collected showed considerable variation between countries in revenue collected and public expenditure per hectare of forest. This is due to various factors such as the difference in forest types in different countries, but also their different levels of economic development (more developed countries are generally able to spend more on forestry than poorer countries). To demonstrate this variation, Lorenz curves were constructed that show how revenue collection and public expenditure are distributed across the global forest resource. These curves were calculated separately for the countries reporting revenue collection and public expenditure and are shown in Figure 7.8 and Figure 7.9.

In Figure 7.8, the distribution of revenue collection shows that very little forest revenue is collected in 46 countries accounting for about 20 percent of the forest area (of all countries reporting revenue collection). Revenue collection in these countries is less than US$1 per hectare. In another 29 countries, forest revenue collection is US$1–5 per hectare. This group includes many of the countries with significant forest areas, such as Canada, Indonesia, the Russian Federation and the United States of America. Between them, these countries account for about 35 percent of revenue collection and 60 percent of the forest area. Starting with Brazil, the final group of 24 countries collects 65 percent of all the forest revenue reported. These countries (many in Europe) account for the remaining 20 percent of the forest area and have levels of revenue collection of over US$5 per hectare.

TABLE 7.4
Sources and uses of public expenditure on forestry by region, 2005

Region	Public expenditure on forestry in 2005							
	Operational expenditure (million US$)			Transfer payments (million US$)			External funding (%)	Transfer payments (%)
	Domestic	External	Total	Domestic	External	Total		
Africa	418	122	541	31	53	84	28	13
Asia	1 699	12	1 712	4 999	43	5 041	1	75
Europe	2 266	151	2 417	1 468	263	1 731	10	42
North and Central America	5 505	30	5 535	751	17	769	1	12
Oceania	15	1	15	0	0	0	4	0
South America	98	5	103	60	2	63	5	38
World	**10 001**	**321**	**10 323**	**7 309**	**378**	**7 687**	**4**	**43**

Note: Totals are less than shown in Table 7.2 above because some countries did not provide a breakdown of their public expenditure.

FIGURE 7.8
Distribution of forest revenue collection at the global level, 2005

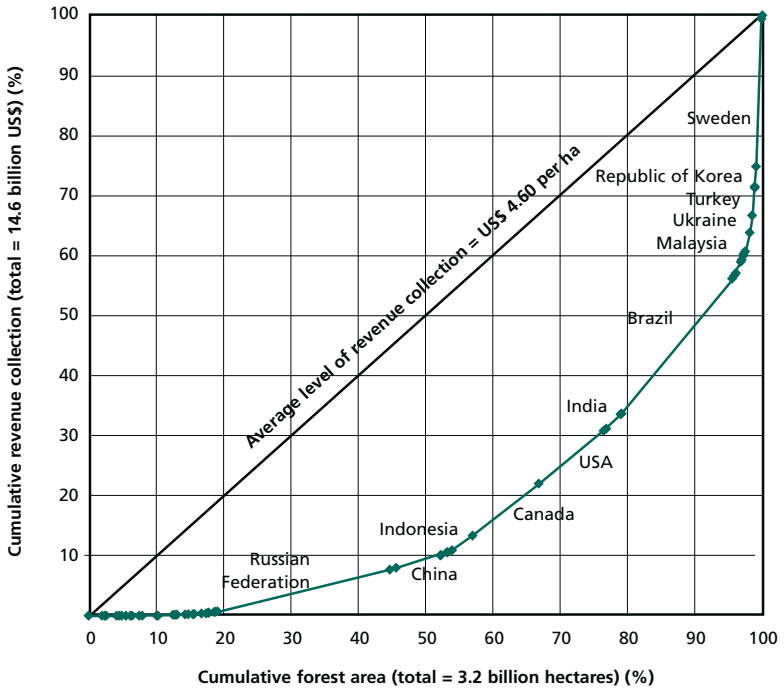
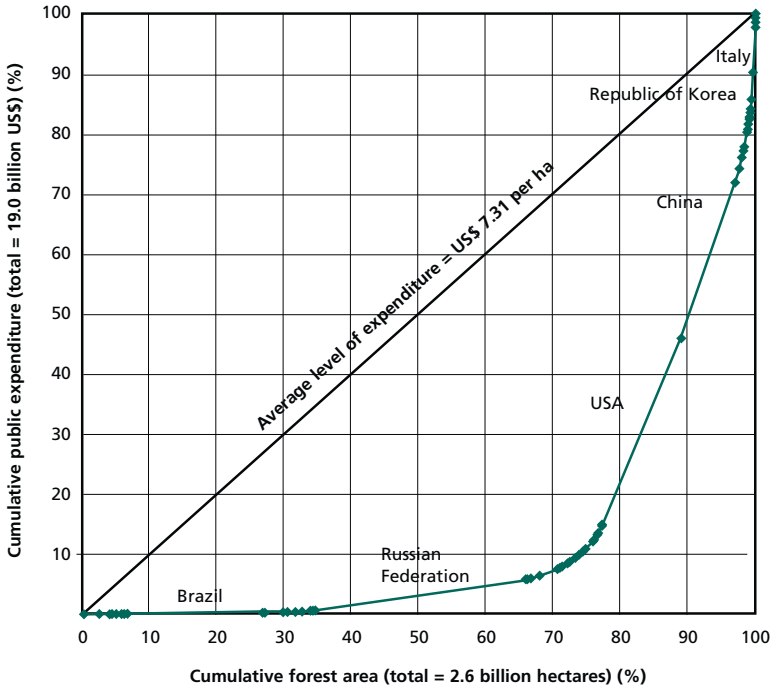


FIGURE 7.9
Distribution of public expenditure on forestry at the global level, 2005

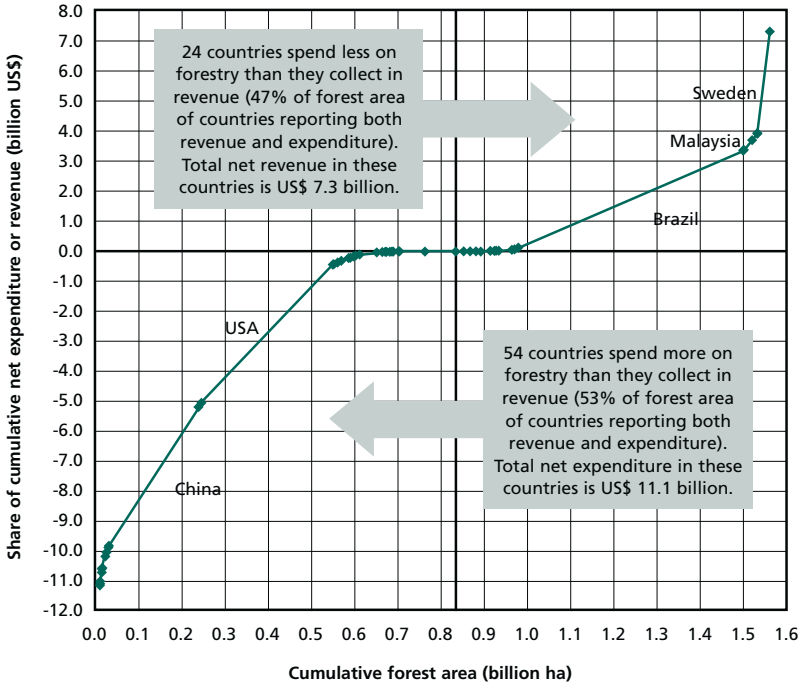

Cumulative public expenditure (total = 19.0 billion US$) (%)
Cumulative forest area (total = 2.6 billion hectares) (%)
Average level of expenditure = US$ 7.31 per ha
Italy
Republic of Korea
China
USA
Russian Federation
Brazil

Thus, to summarize, very little revenue is collected from about 20 percent of the forest area while, at the other end of the scale, the majority of forest revenue is collected from another 20 percent of the area where revenue collection per hectare is very high. In the remaining 60 percent of the forest area between these two extremes, revenue collection per hectare is close to the global average.

The distribution of public expenditure on forestry (Figure 7.9) shows even greater variation between countries. Twenty-seven countries spent less than US$1 per hectare on forestry, accounting for less than 1 percent of all public expenditure on forestry but 35 percent of the forest area. The most significant country in this group was Brazil, where public expenditure on forestry was just under US$0.10 per hectare. A second group of 33 countries spent US$1–10 per hectare on forestry. These countries accounted for a further 40 percent of the forest area and 12 percent of all expenditure. The Russian Federation had the most significant forest area in this group. The last group of 43 countries accounted for 25 percent of the forest area but about 88 percent of all public expenditure on forestry. Again, a few countries (China, Italy, the Republic of Korea and the United States of America) were significant in this group, accounting for a major share of public expenditure on forestry.

As the above figures have shown, there is great variation in revenue collection and public expenditure on forestry and this variation is even greater when the two datasets are combined (because some countries collect a lot of revenue and spend very little while others do the opposite). To show the net flows of funding between governments and the forestry sector, public expenditure was subtracted from revenue collection for those countries providing both of these figures and the results at the global level are shown in Figure 7.10.

FIGURE 7.10
Net revenue collection and public expenditure on forestry, 2005



A much smaller group of countries provided figures for both revenue and public expenditure (78 countries, covering 1.6 billion hectares or 40 percent of the global forest area) and the total net flow of funds in these countries was a net expenditure of US$3.8 billion, indicating that governments, on average, spent more on forestry than they collected in revenue. Roughly two-thirds of these countries (or slightly more than half by forest area) spent more on forestry than they collected in revenue. However, as above, most of the net revenue or net expenditure occurred in a few significant countries and revenue and expenditure were roughly equal in the vast majority of countries. This can be seen in Figure 7.10, as the 48 countries between the United States of America and Brazil that are close to a zero share of cumulative net expenditure or revenue.

Trends

The changes in forest revenue and public expenditure on forestry (between 2000 and 2005) are shown in Table 7.5 and Table 7.6. Fewer countries provided this information for both years and these tables only compare the figures for countries reporting both years. However, they do give a general indication of trends in forest revenue and public expenditure in the different regions and at the global level.

Table 7.5 shows that forest revenue increased by about 44 percent between 2000 and 2005 (or about 7.6 percent per year on average). Industrial roundwood production increased only slightly between these two years (by about 8 percent), so the majority of this increase is due to higher levels of forest charges (per unit of production) and, possibly, higher collection of forest charges on other goods and services provided by forests. These figures are not adjusted for inflation, but indicate that forest revenue collection increased by more than the rate of inflation (i.e. increased in real terms).

At the regional level, all regions increased their revenue collection except Africa. The relatively low increase in North and Central America was largely due to Canada, where production did not increase much between the two years and revenue collection increased only slightly. The very large increase in Europe was largely a result of increases in Sweden and the Russian Federation. In both of these countries, industrial roundwood production increased, but the average level of revenue collection per cubic metre also increased (significantly in the case of the Russian Federation). In Africa, all of the decline in revenue collection was related to Gabon, where revenue collection fell from US$143 million in 2000 to US$16 million in 2005, despite an increase in production. Excluding Gabon, most other countries in this region increased their revenue collection by modest amounts.

TABLE 7.5
Trends in forest revenue collection by region, 2000–2005

Region	Countries reporting both years		Forest revenue			
	Number	% of forest area	2000 (million US$)	2005 (million US$)	Change rate (%)	
					total	per year
Africa	25	58	326	273	-16.3	-3.5
Asia	20	72	1 981	2 510	26.7	4.9
Europe	19	88	3 104	5 410	74.3	11.8
North and Central America	9	45	1 231	1 289	4.7	0.9
Oceania	7	20	103	146	42.1	7.3
South America	5	67	2 213	3 282	48.3	8.2
World	**85**	**66**	**8 957**	**12 910**	**44.1**	**7.6**

Note: The United States of America only provided data for 2000 and is therefore excluded from this table.

Table 7.6 shows that public expenditure on forestry also increased between 2000 and 2005 and by a similar amount to revenue collection (49 percent in total or 8.3 percent per year). At the regional level, there were modest increases in South America, and North and Central America and increases similar to the global average in Europe and Oceania. The two regions with significant increases were Africa and Asia. In the case of Asia, this was due to large increases in transfer payments in some countries (most likely due to increased government support for the establishment of planted forests). In Africa, the increase was mostly due to Morocco and South Africa, where there were large increases in public expenditure on forestry.

Both domestic and external funding increased between 2000 and 2005, but the share of external funding in total public expenditure was largely unchanged (3 percent in 2000 and 4 percent in 2005). Furthermore, this slight increase in external funding occurred mainly in Europe and was most likely a result of the expansion of the European Union (giving more countries access to the European Union's common funds). In addition, there was also a slight increase in external funding for forestry in Africa, while external funding declined in all of the other regions.

The most interesting change in the public expenditure data was the shift in expenditure towards transfer payments that occurred between 2000 and 2005. Transfer payments increased from US$3.7 billion (31 percent of total expenditure) in 2000 to US$7.7 billion (43 percent of the total) in 2005. Furthermore, the total amount of transfer payments increased in all regions (and increased as a proportion of the total in all regions except Europe).

Table 7.5 and Table 7.6 are not directly comparable because data from some countries appear in only one of the tables (e.g. South Africa and the United States of America). They imply that public expenditure has increased by more than revenue collection and that, at the global level, the difference between public expenditure and revenue collection has increased from 2000 to 2005 (i.e. net expenditure has increased). However, as noted above, these figures are very variable between countries, so they can only be usefully interpreted at the country level. Examination of the country data showed that net expenditure or net revenue in each country generally increased between the two years and that, apart from these increases in magnitude, the overall pattern of net expenditure or revenue was similar in 2000 to that shown in Figure 7.10.

Conclusions

Given the huge variations between countries, any conclusions reached from interpretation of these figures are likely to be very general and will not apply to many

TABLE 7.6
Trends in public expenditure on forestry by region, 2000–2005

Region	Countries reporting both years		Public expenditure on forestry			
	Number	% of forest area	2000 (million US$)	2005 (million US$)	Change rate (%)	
					total	per year
Africa	20	36	361	578	60.1	9.9
Asia	19	51	2 969	6 727	126.6	17.8
Europe	24	13	2 792	3 994	43.1	7.4
North and Central America	8	44	5 382	5 910	9.8	1.9
Oceania	4	16	10	14	40.9	7.1
South America	6	71	148	160	7.7	1.5
World	**81**	**40**	**11 663**	**17 383**	**49.0**	**8.3**

countries. However, the figures support four general observations about the status and trends in forest revenue collection and public expenditure in the sector.

The first observation is that, in the majority of countries, public expenditure on forestry is higher than revenue collected from the sector. However, with a few exceptions, this level of support is generally quite modest. Thus, the majority of investment in forest management comes from the private sector (including local communities and individuals as well as the forest industry) and is probably devoted to commercial or productive uses of the forest resource.

A second observation is that public expenditure on forestry is gradually moving away from operational expenditure towards transfer payments. To some extent, this may be due to changes in forest ownership and, especially, government support for planted forest establishment. However, it also suggests that the role of forest administrations is gradually changing away from direct action and regulation of the sector towards facilitation and support for other non-state actors. This is in line with a general trend in public administration in many countries in recent years, where governments are tending to take less of a direct role in service provision and focus more on facilitation and service provision through partnerships with the private sector.

Comparing the two years 2000 and 2005, both revenue collection and public expenditure have increased in real terms (i.e. by amounts higher than the level of inflation), so government interest and involvement in the sector has increased. This is a positive development but, as noted above, the increase in net public expenditure on forestry is only modest in most countries. The non-market benefits of forests are often stressed in forestry policy debates, but forest administrations seem unable to compete with other demands for public funding, to achieve higher levels of public investment in the sector. This suggests that either these benefits are not particularly important (e.g. when compared to other public services) or that forest administrations are not particularly effective at communicating the importance of forests and forestry to decision-makers in government.

Finally, the one region that appears very different from the others is Africa (both at the regional and country levels). Revenue collection and public expenditure are comparatively low in Africa and the region relies greatly on external assistance; the majority of public expenditure on forestry in the region is destined for operational expenditure. To some extent, these figures reflect some of the general constraints to development in Africa. However, they also imply that governments have relatively little interest or capacity to support the sector. Given that the majority of forest resources in this region are still nominally owned or controlled by the government (in many of these countries, all forest is publicly owned), this suggests that existing arrangements for forest administration in Africa may be quite ineffective.

VALUE OF WOOD AND NON-WOOD FOREST PRODUCT REMOVALS

Introduction

The value of wood and NWPF removals is an indicator of the contribution of forests and woodlands to national economies and is the indicator of socio-economic benefits that is generally most easy to quantify and interpret. These figures also provide some indication of how the sector contributes to poverty alleviation (especially in the case of NWPFs, which are often collected by poor people), although they mostly fail to include the very important contribution that subsistence production and consumption may make to local livelihoods. To compensate for annual fluctuations of volumes removed and their value, the figures for value of wood removals are five year averages i.e. the average of 1988–1992 for 1990, 1998–2002 for 2000 and 2003–2007 for 2005. As information on NWPFs is often limited, countries were only asked for the value of these for 2005.

Status

Information about the total value of wood removals in 2005 was provided by 112 countries covering 85 percent of the total forest area (see Table 7.7).[28] Countries were also asked to provide this information divided into industrial roundwood and woodfuel. Many countries responded for industrial roundwood, but far fewer provided information about the value of woodfuel removals.

With the exception of the Democratic Republic of the Congo, most of the countries that did not supply this information have relatively limited wood production. Considering this, and the fact that the value of woodfuel removals is generally low, the data collected for FRA 2010 gives a reasonable indication of the value of wood removals at the global and regional levels.

A total of 85 countries, accounting for 77 percent of the global forest area, provided information on the value of NWFP removals (using the same methodology as that described for the quantity assessment in Chapter 5). At the regional and subregional levels, the highest response rate (based on the forest area of countries reporting data) was achieved in North America, followed by East Asia, Europe, Southeast Asia, South America, Oceania, Africa and Western and Central Asia.

In general, more information was reported about the value of plant products than animal products (except in OECD countries). Within the plant product categories, most information was available for food, exudates, ornamental plants, and medicinal and aromatic plants. For animal products, most information was available for honey and beeswax.

It should be noted that there are a number of problems with assessing the value of NWFP removals. One is that the assessment asked for the value of primary production (i.e. excluding the income from downstream processing outside the forest), but in many cases countries reported figures for the values of semi-processed products (which are often significantly higher to cover transport and labour costs). For example, some countries provided value data on their production of shea nut butter, which is obtained by processing the seeds of the *Butyrospermum parkii* tree, rather than assessing the value of the seeds. Another example is the case of wild honey, which is collected in forests and refined and graded (at various levels) before being brought to the market. Many countries provided value data based on this final market value.

Another problem is many countries only reported the value of their five to ten most important NWFPs and did not provide estimates of the total value of all NWFPs

TABLE 7.7
Number of countries reporting value of wood removals by region, 2005

Region	Woodfuel		Industrial roundwood		Total	
	Number of countries reporting	% of forest area	Number of countries reporting	% of forest area	Number of countries reporting	% of forest area
Africa	23	32	25	46	33	50
Asia	13	24	22	74	24	73
Europe	26	96	29	96	29	96
North and Central America	3	53	8	98	8	98
Oceania	2	1	6	98	6	98
South America	5	67	12	93	12	93
World	**72**	**57**	**102**	**84**	**112**	**85**

[28] Some countries only provided information for the value of woodfuel or industrial roundwood removals (e.g. Canada, China and Malaysia only provided the latter) and did not present a total on the FRA questionnaire. In such cases, these figures were used for the totals in the analysis and were included in the tables presented here.

produced in the country. Most countries also only reported the value of NWFPs that are used commercially and did not estimate the value of those mainly used for subsistence.

Given these measurement problems, the figures for the value of NWFP removals are very imprecise and could be significant over- or underestimates, depending on the types of products removed, their uses and the different methodologies employed to estimate their values. However, they give a very broad indication of the importance of different products, regional variations and the relative importance of NWFPs compared to removals of wood products.

Table 7.8 shows that the total value of forest product removals in 2005 was US$121.9 billion; about 71 percent of this was from industrial roundwood, 15 percent from NWFPs and 14 percent from woodfuel.

At the regional level, most of the value of removals occurred in three regions: Asia, Europe and North and Central America. These three regions together accounted for 87 percent of the total value of removals. The other interesting result at the regional level was the very different composition of the value of removals in different regions. In North and Central America, Oceania and South America industrial roundwood accounted for almost all of the value of removals. The value of woodfuel removals was particularly important in Asia and Africa (although this may be under-reported in many of the other regions).

Table 7.8 also shows the value of wood removals per cubic metre. As would be expected, the average value of woodfuel was much lower (US$18 per cubic metre) than the value of industrial roundwood (US$51 per cubic metre). At the regional level, the differences in unit values were significant and can be explained by a number of factors. First, the relative abundance and scarcity of wood in different regions (i.e. supply and demand balance) may partly explain why the value of woodfuel and industrial roundwood removals in Asia was relatively high while the value of industrial roundwood removals in South America was relatively low. Second, species composition may account for some of the variation (e.g. removals of high value tropical species probably contribute to the higher unit values of removals in Africa and Asia). Similarly, regions with a relatively high proportion of removals from planted forests (e.g. Europe and South America) might be expected to have relatively low unit values, because the value of roundwood from planted forest is generally low compared to production from natural forests.

The variation in the average value (or price) of industrial roundwood removals is also interesting and is shown in Figure 7.11. This shows that the majority of industrial roundwood had a value of US$30–70 per cubic metre and the value of roundwood in

TABLE 7.8
Total value of wood and NWFP removals by region, 2005

Region	Wood						NWFPs	All products
	Woodfuel		Industrial roundwood		Total		Total (billion US$)	Total (billion US$)
	billion US$	US$/m³	billion US$	US$/m³	billion US$	US$/m³		
Africa	1.4	7	2.9	54	4.3	16	0.5	4.8
Asia	10.3	27	18.1	100	28.4	51	7.0	35.4
Europe	3.4	23	20.7	40	24.1	36	8.4	32.5
North and Central America	0.4	7	37.0	53	37.3	49	1.7	39.0
Oceania	0	14	2.7	51	2.7	51	0.4	3.1
South America	1.8	12	4.7	25	6.4	19	0.5	6.9
World	**17.2**	**18**	**86.1**	**51**	**103.4**	**39**	**18.5**	**121.9**

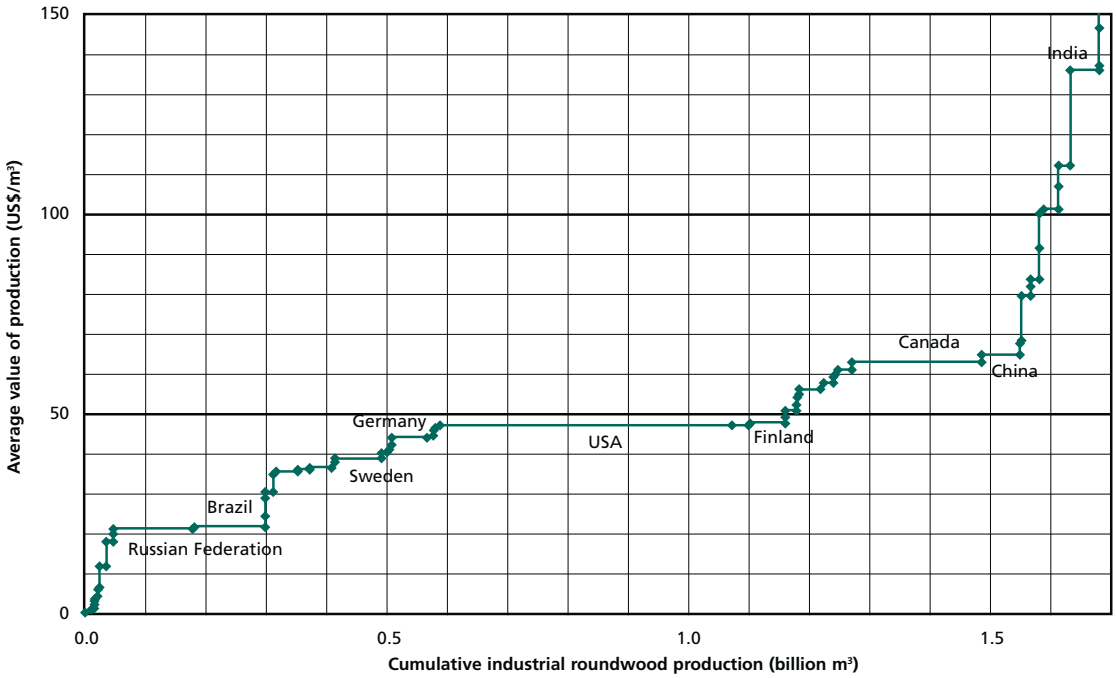
many of the world's major wood producing countries fell into this range. Significant producers with relatively low industrial roundwood values included Brazil and Russia, whereas the value of roundwood in India (where wood is scarce compared to the size of the population) was very high. The average value of industrial roundwood varied between countries (and was also variable within countries) for a number of reasons. Nonetheless, Figure 7.11 provides a very general indication of average industrial roundwood prices in different countries.

Table 7.9 shows the relative importance of the different NWFPs (in terms of the value of removals) at the global and regional level.[29] At the global level, five major categories accounted for 90 percent of the total value of NWFP removals: food (51 percent), other plant products (17 percent), honey (11 percent), ornamental plants (6 percent) and exudates (4 percent).

Plant products (eight categories) accounted for 84 percent of the total value of NWFP removals and food had the highest value (US$8.6 billion). Fruit, berries, mushrooms and nuts were identified as the main food products by most countries. Other plant products (US$2.8 billion) included a wide range of species used mainly for non-food purposes (e.g. the production of bidi leaves in India).

The removal of animal products had a total value of US$2.7 billion, with US$1.8 billion from honey and beeswax, and US$0.6 billion from wild meat production. However, these figures may not include a significant amount of animal products. For example, the reported value of wild meat (bushmeat) removals outside Europe was

FIGURE 7.11
Value of industrial roundwood removals, 2005



[29] The total value for the 15 NWFP categories is lower than the total global reported value of US$18.5 billion, because the values of 'any other plant or animal products' (over and above the top ten products) are not shown here.

TABLE 7.9
Value of NWFP removals by category and region, 2005

NWFP categories	Total (million US$)	Share of each category in total value (%)					
		World	Europe	Asia	Americas	Oceania	Africa
Food	8 614	51	48	67	23	47	39
Other plants products	2 792	17	3	22	61	3	7
Wild honey and beeswax	1 805	11	21	n.s.	n.s.	12	n.s.
Ornamental plants	984	6	10	1	3	4	0
Exudates	631	4	1	7	5	0	25
Plant materials for medicine, etc.	628	4	5	2	1	9	18
Wild meat	577	3	7	n.s.	n.s.	1	2
Materials for utensils, construction, etc.	427	3	3	1	3	18	n.s.
Hides, skins and trophies	183	1	1	n.s.	3	7	n.s.
Living animals	154	1	2	n.s.	n.s.	0	7
Fodder	21	n.s.	n.s.	n.s.	n.s.	0	2
Colorants and dyes	18	n.s.	n.s.	n.s.	n.s.	0	n.s.
Other non-edible animal products	6	n.s.	0	n.s.	0	0	n.s.
Other edible animal products	1	n.s.	n.s.	0	0	0	n.s.
Raw animal material for medicine	0	n.s.	n.s.	0	0	0	0
Total value (million US$)	**16 839**	**16 839**	**8 389**	**5 655**	**2 132**	**402**	**261**

Note: n.s. = 'not significant' (i.e. less than one percent of the total)

only US$10 million, which is likely to be a vast underestimate of the true value of removals in other regions.

In Europe, major producers of NWFPs included the Russian Federation (61 percent of the European total), Germany (7 percent), Spain (6 percent), Portugal (5 percent), and Italy (4 percent). Together, these countries accounted for 83 percent of the European total. Three NWFP categories in Europe accounted for 79 percent of the total value of removals: food (48 percent), honey (21 percent) and ornamental plants (10 percent). The reported value of wild meat removals was close to US$0.6 billion and the value of all hunting products combined amounted to about 10 percent of the total.

In Asia, three countries accounted for 96 percent of the value of all NWFP removals: China (67 percent), Republic of Korea (26 percent) and Japan (3 percent). Food was by far the most significant product (67 percent of the Asian total), followed by other plant products (22 percent) and exudates (7 percent).

In the Americas (North, Central and South America, plus the Caribbean), the United States of America accounted for 61 percent of the value of NWFP removals, followed by Brazil (13 percent), Canada (12 percent) and Colombia (7 percent). Together, these four countries accounted for 93 percent of the reported total. Major NWFP categories were other plant products (61 percent of the total), food (23 percent) and exudates (5 percent).

South Africa accounted for 71 percent of the total value of NWFP removals in Africa, followed by Sudan (10 percent). Food and exudates (mainly gum arabic) were the most important NWFPs, accounting for 39 percent (food) and 25 percent (exudates) of the total value of production.

In Oceania, food accounted for nearly half (47 percent) of the value reported, followed by materials for utensils and construction (18 percent) and wild honey and beeswax (12 percent).

At the country level, China and Russia accounted for half of the global value of NWFP removals and 23 countries accounted for 96 percent of the global total. Countries with high values of NWFP removals are shown in Figure 7.12.

Trends

Due to a number of factors, comparisons of the value of wood and NWFP removals in different years may be very unreliable. First, trends in the value of wood removals can only be analysed for countries supplying information for all the years requested in the FRA 2010 enquiry, but the number of countries reporting this information was very low (see Table 7.10). Second, in the case of NWFPs, the amount and reliability of data probably improved significantly in FRA 2010 compared with the previous assessment (see below), so any difference between the values reported for FRA 2005 and FRA 2010 is likely to reflect improvements in data collection and reporting rather than real trends in values.

Finally, the values of removals may fluctuate greatly from year to year (depending on market conditions), so information for only a few years may reflect short-term

FIGURE 7.12
Countries with high values of NWFP removals, 2005

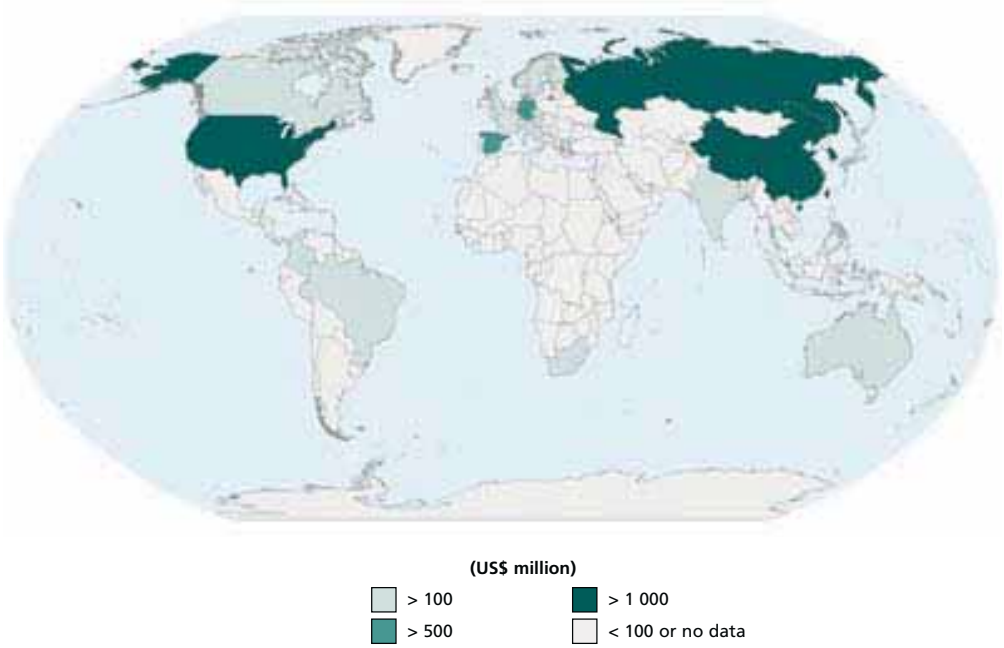


TABLE 7.10
Countries reporting on value of wood removals by region, 1990, 2000 and 2005

Region	Woodfuel		Industrial roundwood		Total removals	
	Number of countries reporting	% of forest area	Number of countries reporting	% of forest area	Number of countries reporting	% of forest area
Africa	14	23	19	35	22	36
Asia	11	24	18	72	21	73
Europe	20	15	23	15	23	15
North and Central America	3	53	5	97	5	97
Oceania	1	0	3	20	4	20
South America	4	67	7	70	7	70
World	**53**	**35**	**75**	**53**	**82**	**53**

changes in market values rather than long-term trends. This is particularly true for industrial roundwood, where a more complete time series (i.e. annual figures over many years) would be required to get a better picture of trends in values.

Table 7.11 compares the values of wood removals in 1990, 2000 and 2005. The countries supplying this information only accounted for about half of the global forest area and the table does not show the value of woodfuel removals separately (although this is included in the calculated totals). The table shows that the total value of wood removals in 1990 and 2000 were roughly the same but increased by 31 percent between 2000 and 2005 (with the same trends for industrial roundwood removals, which account for the majority of the total).

At the regional level, two different trends are present in the data. Africa, Asia, Europe and South America showed a decline in the value of roundwood removals from 1990 to 2000, followed by an increase from 2000 to 2005. Similar trends also appear in the values of removals per cubic metre in these regions. In North and Central America and Oceania, the figures show an increase in the value of removals throughout the period.[30]

These comparisons between years can be partly explained by short-term market conditions. The decline in the value of removals in Asia (1990–2000) is partly due to the economic crisis that affected much of this region at the end of the 1990s. This resulted in a decline in both removal volumes and unit values. In Europe, the relatively low figure for 2000 reflects the longer and more gradual process of market liberalization in Eastern Europe that occurred throughout the 1990s. This started with dramatic falls in removal volumes and unit values at the start of the 1990s, followed by a gradual increase in volumes and values as markets across Europe began to converge. In both cases, the value of removals per cubic metre was still lower in 2005 than in 1990, although close to previous levels.

In North and Central America and Oceania these economic events did not have as great an impact on the markets for roundwood because most wood removals are used within the country or region or are traded with other countries that were less affected by such events (e.g. Japan). However, international trade in wood and wood products is much more important in South America and Africa and this could partly explain why the trends in these regions are similar to those in Europe and Asia.

In the case of NWFPs, trends cannot be calculated because countries were only asked to provide data for one point in time (2005). The reported global value of NWFP removals in FRA 2005 was US$4.7 billion, compared with the figure of US$18.5 billion in FRA 2010. However, a much larger number of countries (85) reported the value of

TABLE 7.11
Trends in value of wood removals by region, 1990–2005

Region	Industrial roundwood removals						Total roundwood removals		
	Total value (billion US$)			Unit value (US$/m³)			Total value (billion US$)		
	1990	2000	2005	1990	2000	2005	1990	2000	2005
Africa	1.7	1.1	1.7	50	28	38	2.6	2.1	2.9
Asia	21.7	15.1	18.1	106	92	100	31.0	22.9	28.4
Europe	14.5	11.6	17.2	49	34	46	17.0	13.4	20.3
North and Central America	18.1	28.6	36.7	26	40	52	18.4	29.0	37.1
Oceania	0.6	0.9	1.5	40	39	55	0.6	0.9	1.5
South America	4.2	3.1	4.4	28	21	24	5.5	4.4	6.1
World	**60.8**	**60.4**	**79.7**	**43**	**42**	**53**	**75.2**	**72.8**	**96.3**

[30] However, it should also be noted that the value of wood removals has declined again in many regions since 2005, as a result of the economic recession at the end of this decade.

NWFP removals in the more recent enquiry and the quality of reported data appeared to be much higher. Therefore, this significant increase is mainly due to changes in the amount and quality of data collected this time rather than a real increase in values.

Conclusions

The figures presented above show that industrial roundwood remains by far the most important output from forests (in terms of market value) at the global level and in every region. However, they also show that this value can vary considerably over time, due to changes in market conditions.

Interestingly, the total value and unit value of wood removals has only increased in real terms in North and Central America and in Oceania. In all other regions, these values have increased by less than the rate of inflation or, in some cases, have even declined. Although these trends only cover about half of the global forest area, this suggests that significant changes are occurring in the supply of roundwood. At least part of these changes may be due to the growing importance of planted forests in global wood supply. One implication of these trends is that, if the value of removals continues to stagnate or fall, income from wood production will also fall and forest owners and managers will find it more difficult to invest in forest management in natural forests. This has wider implications for the question of how sustainable forest management should be financed and implemented.

It is important to recognize and applaud the significant efforts that countries have made to improve the quality of their NWFP reporting for FRA 2010. The 85 countries that provided NWFP value data have a total forest area of 3.1 billion hectares (77 percent of the total forest area), which is a great improvement on past enquiries.

Although the availability of information may still be quite limited, the significant value of NWFP removals clearly underlines the importance of this sector for national economies, rural development and poverty alleviation. Given that NWFP removals benefit large numbers of people, there is an urgent need to improve these statistics to explain more precisely the contribution of NWFPs to sustainable forest management, nature conservation, poverty alleviation and economic development. This is especially true for the many developing countries working towards achieving the Millennium Development Goals.

EMPLOYMENT

Introduction

The level of employment in forestry is an indicator of both the social and economic value of the sector to society. Employment provides income and, as forestry activities occur in rural areas that are often poorer than the average, it gives some indication of the sector's contribution to poverty alleviation. In social terms, employment is valuable because it enables individuals to be productive members of society.

It is important to gather and analyse this information as it is a significant indicator of the impact of forests on people and demonstrates the contribution of the sector to broader economic aims and objectives. Governments are concerned about the level of employment and this is often a major performance indicator for government policy.

For FRA 2010, employment was defined as:

> *"Persons who during a specified reference period performed some work for wage or salary (paid employment) or profit or family gain (self-employment) in cash or in kind".*[31]

[31] This definition was based on definitions used by the International Labour Organization and the United Nations Statistics Division.

However, information was requested only on employment related to the primary production of forest goods and related services (i.e. excluding the processing of wood and NWFPs). Thus the figures cannot be compared with statistics on employment in the forestry sector as a whole. In contrast to FRA 2005, the definition of "Employment in primary production of goods" used this time was aligned with the International Standard Industrial Classification (ISIC) of economic activities, generally used by national statistical agencies in most countries.[32]

Status

At the global level, 141 countries[33] reported on forestry employment in the primary production of goods and 76 countries reported on employment in the management of protected areas. Those reporting for all three years account for about 60 percent of global forest area.

As a check on the quality of the information, the data provided for FRA 2010 were compared with the statistics on forestry employment reported by national statistical offices (FAO, 2008c). This detailed examination of the quality of the statistics revealed a number of problems and issues, especially with a few large countries, which had a major impact on the global results (see Box 7.2).

The total reported level of employment in forestry in 2005 was about 11 million people (see Table 7.12). Regionally, the reported level of employment is highest in Asia (8.4 million), with India accounting for three-quarters of this and China a further 15 percent (1.3 million). Reported employment in the management of protected areas accounted for only about three percent of total employment in forestry.

BOX 7.2

Problems and issues with the estimation of employment levels in forestry

It appears that some countries may have reported the number of people employed part time in the sector, without converting these figures to full time equivalents. India provided the most notable example of this, where the national report showed very high levels of employment in the sector (6.4 million people in 1990 and 6.2 million in 2005). This was largely a result of the inclusion of some very high numbers for people employed in the establishment of forest plantations. These employment estimates were based on the number of hectares planted multiplied by the average number of people employed per hectare. For forest plantation establishment, this factor was reported to be 3 persons per hectare. While 3 persons per hectare, on average, may have been employed temporarily at some time in planting trees, it seems very unlikely that this is a figure for permanent employment in tree planting.

Moreover, most countries (including India) stated that their data did not include the number of people collecting woodfuel and NWFPs for subsistence purposes. Although the guidelines and definitions (FAO, 2007h) noted that all employment should be included in the statistics, it seems likely that employment in subsistence production was not captured here for most countries. In addition, where countries did provide subsistence employment figures, the data and methodologies used to estimate these figures seemed quite weak and differed between countries.

[32] The FRA 2010 definition of forestry employment also included employment in Christmas tree, rubber and bamboo plantations. This differs from the ISIC definition, which counts these activities as agriculture rather than forestry.

[33] Ten of these countries only provided information on paid employment.

In 2008, FAO estimated that total employment in forestry in 2005 was 4 million (FAO, 2008b). Although that figure included estimates for a number of countries, it is notable that the statistics reported above amount to more than twice this figure. However, one country – India – accounts for much of this discrepancy.[34] In many other countries, the figures reported here and in FAO (2008c) are quite similar or can be explained by differences in definitions.

Trends

Table 7.13 shows global and regional trends in employment, based on the data from countries that reported on employment for all three years (1990, 2000 and 2005). Globally, reported employment in forestry declined slightly from 1990 to 2005 by about 1 million (or 10 percent) and most of this decline occurred during the 1990s. Asia

TABLE 7.12
Number of people employed in forestry by region, 2005

Region	Data availability				Number employed (thousand FTE)		
	Primary production of goods		Management of protected areas		Primary production of goods	Management of protected areas	Total
	Number of countries	% of forest area	Number of countries	% of forest area			
Africa	34	52	20	25	573	13	586
Asia	31	83	19	73	8 232	179	8 411
Europe	35	99	20	91	1 113	126	1 239
North and Central America	16	89	8	43	354	16	370
Oceania	6	98	3	4	27	2	28
South America	10	84	6	75	239	3	242
World	**132**	**84**	**76**	**61**	**10 537**	**338**	**10 876**

TABLE 7.13
Trends in number of people employed in forestry by region, 1990–2005

Region	Data availability				Number employed (thousand FTE)								
	Primary production of goods		Management of protected areas		Primary production of goods			Management of protected areas			Total		
	Number of countries	% of forest area	Number of countries	% of forest area	1990	2000	2005	1990	2000	2005	1990	2000	2005
Africa	26	44	12	20	333	391	427	9	10	10	342	401	437
Asia	31	87	12	53	8 911	8 196	8 150	43	102	160	8 954	8 298	8 310
Europe	31	95	9	5	1 672	1 076	1 005	5	10	11	1 677	1 086	1 016
North and Central America	11	89	4	0	223	252	234	–	–	–	223	252	234
Oceania	5	98	3	4	25	28	26	1	1	2	27	30	28
South America	5	7	3	6	46	53	59	1	1	1	47	54	60
World	**109**	**65**	**43**	**14**	**11 210**	**9 996**	**9 901**	**60**	**125**	**184**	**11 270**	**10 121**	**10 085**

[34] The figure presented in FAO (2008c) was based on the results of an earlier FAO survey of forestry employment, in which India reported a 1994 level of employment of only 263,000 people (compared with over 6 million reported to FRA 2010).

and Europe accounted for all of this decline, while in the other regions employment increased slightly.

These changes in employment can be explained by a number of factors. In general, this decline has occurred in the primary production of goods, which can probably be attributed to increases in labour productivity (e.g. increased mechanization of harvesting operations). The fall in employment in Asia was influenced by a steep decline in China because of the partial logging ban in the late 1990s. In Europe, the decline in employment numbers can be explained by the restructuring of formerly centrally-planned economies. In some countries this has led to decreased production and lower employment. More generally, the privatization of forestry activities in Eastern Europe has led to large increases in labour productivity in the region and, as a consequence, a decline in employment numbers. In the regions showing an increase in employment, this is partly because roundwood production has increased faster than labour productivity (for a more detailed discussion, see FAO, 2008c).

Conclusions

Given the unreliability of some of these figures, it is not possible to draw any robust conclusions about the current status and trends in forestry employment on the basis of the data collected at the global and regional levels. However, the figures suggest that employment is probably declining somewhat in most countries and regions.

A focused effort should be made to improve the quality of employment statistics in a few key countries in which the reported statistics are missing or are very high but may be based on minimal survey data or very simple estimation techniques.

AREA OF FOREST DESIGNATED FOR SOCIAL SERVICES

Introduction

The area of forest designated for social services indicates the extent to which countries and forest managers have identified specific forests areas for recreation, tourism, education, research and for the conservation of cultural or spiritual sites.

Out of the total of 233 countries and areas covered by FRA 2010, 205 provided data on the designated functions of their forests, together accounting for 99.9 percent of the total forest area. Many countries reported that they did not have forest areas specifically designated for this purpose, while data were incomplete in others. Just 59 countries designated more than 1 000 ha of forests under this category and only 53 of these provided a complete data series (1990, 2000, 2005 and 2010).

Many countries recognize the importance of this function but have included it under the category of multiple use and/or unknown function when it was not possible to quantify the area. The United States of America, for instance, did not report any forest area designated primarily for social services, but included such areas within the multiple use category while noting that 85 percent of the national forest area was available for outdoor activities. Many forests in Africa and elsewhere are used for tourism, but the main function, in most cases, is the conservation of wildlife. National parks were therefore mostly assigned to the category conservation of biological diversity rather than social services. Even among the countries that did report areas designated for social services, there continued to be different interpretations of which areas should be included in this category[35] and figures are, therefore, not always comparable between countries.

[35] Brazil and Guyana reported on forests designated for the protection of the culture of indigenous and forest-dependent peoples, seven countries focused on recreation and highlighted the importance of urban forests, three countries focused on sacred forests, two on education and one made specific reference to human well-being. The remaining countries referred to tourism or a combination of the purposes mentioned above.

Status

Globally, an estimated 3.7 percent of the world's forests were designated for the provision of recreation, tourism, education or conservation of cultural and spiritual heritage. However, the only subregions and regions with fairly good data were East Asia and Europe. The provision of such social services was reported as the primary management objective for 3 percent of the total forest area in East Asia and 2 percent in Europe (see Table 7.14).

The top five countries with forest areas designated for social services were Brazil, the Russian Federation, China, Japan and Ukraine, which together designated some 142 million hectares for this purpose. Brazil has designated 119 million hectares, or more than one-fifth of its forest area, for the protection of the culture and way of life of forest-dependent peoples. This area accounts for more than three-quarters of the total area of forest designated for social services worldwide.

At the regional level, South America contributed 78 percent (mainly in Brazil) of the total area in this category; Europe 14 percent; and Asia 7 percent. The remaining regions together accounted for around 1 percent of the total area designated for the provision of social services.

Trends

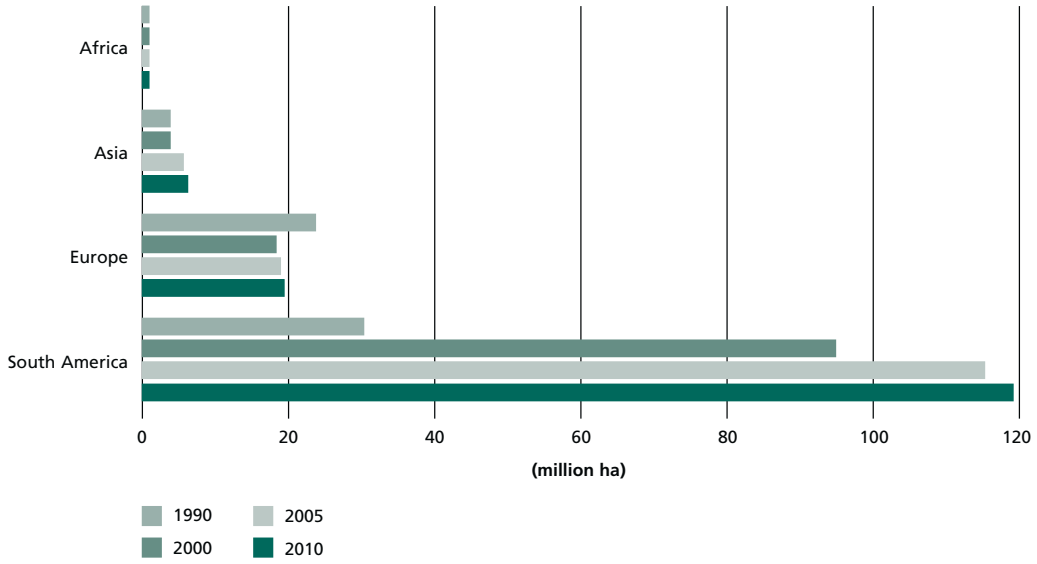
The analysis of trends of forest area designated for social services is based on those countries and areas that reported a complete time series.

The strong trend towards increasing area in South America (see Figure 7.13) is entirely accounted for by Brazil, where large areas of forest were designated as 'indigenous lands' and 'sustainable development reserves' during the 1990s. Europe shows a decrease in forest area designated for social services between 1990 and 2000 and an increase from 2000 to 2010, while Asia (mainly East Asia) reported a slight increase in the last decade. The trend in Africa was stable.

TABLE 7.14
Area of forest designated for social services by region and subregion, 2010

Region/subregion	Information availability		Area designated for social services	
	Number of countries	% of total forest area	1 000 ha	% of forest area
Eastern and Southern Africa	23	100.0	464	0.2
Northern Africa	7	99.1	3	n.s.
Western and Central Africa	24	100.0	434	0.1
Total Africa	**54**	**99.9**	**901**	**0.1**
East Asia	5	100.0	8 347	3.3
South and Southeast Asia	17	100.0	283	0.1
Western and Central Asia	24	100.0	823	1.9
Total Asia	**46**	**100.0**	**9 453**	**1.6**
Europe excl. Russian Federation	45	100.0	6 432	3.3
Total Europe	**46**	**100.0**	**19 377**	**1.9**
Caribbean	12	53.8	19	0.5
Central America	7	100.0	767	3.9
North America	5	100.0	0	0
Total North and Central America	**24**	**99.5**	**786**	**0.1**
Total Oceania	**21**	**99.8**	**67**	**n.s.**
Total South America	**14**	**100.0**	**119 561**	**13.8**
World	**205**	**99.9**	**150 146**	**3.7**

FIGURE 7.13
Trend in forest area designated for social services by region, 1990–2010



Note: North and Central America is not included because countries in this subregion reported no areas designated for this function. Oceania is excluded due to low information availability of trend data.

Conclusions

A higher percentage of the world's countries reported on the designated functions of forests for FRA 2010 (81 percent) in comparison with the FRA 2005 (75 percent). However, there continue to be substantial data gaps in terms of the area of forest designated for social services and a wide range of interpretations of which areas should be included in this category, which make comparison between countries and regions difficult.

The main conclusion therefore remains that the management of forests for social and cultural functions is increasing, but the area is difficult to quantify. Future assessments should focus on obtaining more detailed and more comparable data on this variable.

Chapter 8

Legal, policy and institutional framework

OVERVIEW

The national legal, policy and institutional framework related to forests constitutes the fundamental basis for sustainable forest management. National forest programmes provide an internationally agreed framework which many countries use for the development and implementation of national forest-related policies and international commitments. The effective development and implementation of forest policy depends on the institutional capacity of national and subnational forest agencies. These include, among others, forest administrations, agencies responsible for the enforcement of forest laws and regulations and forest research and education institutions. For FRA 2010 countries were asked for the first time to report on these key aspects, with the aim of addressing a critical information gap on the governance of the world's forests.

More specifically, for FRA 2010 countries were asked to provide information on the following variables:

- the existence of a national and/or subnational forest law, date of enactment and date of latest amendment;
- the existence of a national and/or subnational forest policy and date of endorsement;
- the existence of a national forest programme, date of commencement and its current status;
- the institutional structure related to forests and forestry;
- human resources in public forestry institutions;
- the number of graduates in forest-related education;
- the number of professional staff in publicly funded forest research centres.

In addition, information was compiled on international conventions and agreements related to forests and the extent to which countries have ratified or adopted these.

KEY FINDINGS

Significant progress has been made in developing forest policies, laws and national forest programmes. Of the 143 countries that reported the existence of a forest policy statement, 76 have issued or updated their statements since 2000. Of the 156 countries that have a specific forest law, 69 countries – primarily in Europe and Africa – reported that their current forest law was enacted or amended since 2005. Close to 75 percent of the world's forests are covered by national forest programmes, most of which were started since 2000 and are currently in implementation.

Staff numbers in public forest institutions are decreasing

Around 1.3 million people were reported to work in public forest institutions, 22 percent of whom were female. At the global level, the number of staff has declined by 1.2 percent annually since 2000. More than 20 000 professionals work in public forest research institutions. Forest policy is mostly within the purview of the ministry of agriculture, but only about one-third of heads of forestry agencies report directly to the minister. The others report to lower levels in the ministry.

The number of university students graduating in forestry is increasing

More than 60 000 university students graduate in forestry annually. This is about 1 per 86 000 inhabitants, or around 200 per 10 million hectares of forests. One-third of graduating students are female, and this proportion is increasing.

KEY CONCLUSIONS

The high response rate on this theme, particularly from developing countries, in this first reporting within the FAO Global Forest Resources Assessments provides important global reference data. The findings show that countries have been very active in developing and updating their forest policies, programmes and legislation in the years since 2000, often using national forest programmes as a comprehensive forest policy framework.

The status of, and trends in, human resource capacity in public forest administrations provide an indication of a country's ability to govern its forests. While existing data indicate that the number of staff is decreasing, little is known about trends in staff quality. It is also noteworthy that only 63 percent of countries provided information on human resources.

In many countries national capacities in forest education and research seem to be inadequate to support the sustainable development of the forestry sector and respond to new issues. While the data indicate growing numbers of university level graduates, it remains unclear how well this education enables them – including graduates working in forest research institutions – to face up to the challenges of a globalized world.

POLICY AND LEGAL FRAMEWORK

Introduction

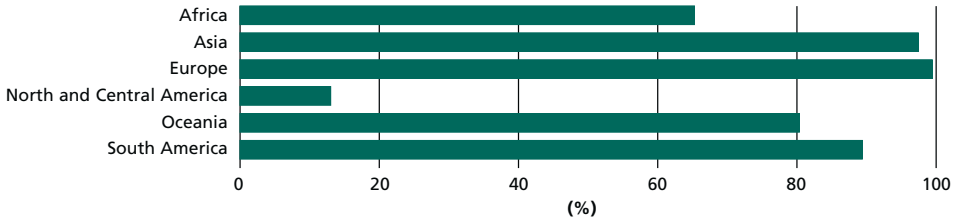
The national or subnational policy framework on forests and their management aims to guide decision-making and provide a clear sense of direction over time. In the context of international commitments many countries have agreed to use 'national forest programmes' (NFPs) as a comprehensive framework in order to develop and implement their forest policies. The legal framework provides a key instrument in support of the national forest policy. Together the national policy and the legal framework related to forests constitute the basis for sustainable forest management.

Status

Globally, 181 countries and areas reported on forest policies. Of these, 143 countries (more than 80 percent), accounting for more than 70 percent of the total forest area, responded that they had a forest policy statement. The large majority of countries reported that they had a national level policy statement; only eight countries – among them Brazil – reported that they had subnational statements but no national forest policy statement. Thirty-eight countries and areas reported that they did not have a forest policy statement. Countries without a forest policy statement were mainly found in Western and Central Asia, Europe and Africa. Fifty-two countries and areas did not report on this variable.

A total of 178 countries and areas reported on NFPs. Almost three-quarters of these (74 percent, 131 countries) stated that they had an NFP as of 2008. Together, these countries account for around 75 percent of the global forest area (Figure 8.1). Only a few countries had a forest policy statement but no NFP, and even fewer reported that they had an NFP but no policy statement. Around two-thirds of the responding countries (66 percent) reported that their NFP was in the implementation stage. In close to one-third of the remaining countries, NFPs were either in development or under revision. In a few countries the NFP process was stalled at the time of reporting. Forty-seven countries stated that they had no NFP, while 55 did not provide data. Overall, more NFPs were reported in Africa and Europe compared with

FIGURE 8.1
Percentage of forest area covered by national forest programmes by region and subregion, 2008



other regions, while North America had the lowest proportion of countries reporting an NFP.

Of the 233 countries and areas included in FRA 2010, 182 (covering 99.4 percent of the world's forests) reported on forest legislation. The remaining 51 countries and areas, with a combined forest area of 24.7 million hectares (0.6 percent of the world's forests), did not report. Forest management is regulated through a specific forest law in 156 countries, or 86 percent of those reporting. In the vast majority of these (150 countries) a specific forest law exists at the national level, while in six countries forests are regulated through subnational but not national legislation. Seventeen countries reported that forests are not covered through specific laws but are incorporated under other legislation. Nine countries, mostly small island states, reported that forests are not covered under legislation at all. Eight of these nine also reported no forest policy statement or NFP. Six countries govern their forests through national forest legislation only, without a forest policy statement or NFP. Two countries reported the existence of a forest policy statement but did not have specific forest legislation.

Table 8.1 summarizes the information on forest policies, NFPs and forest laws by region and subregion. Box 8.1 lists the main international conventions and agreements related to forests and the extent to which countries have ratified or adopted these. For country-level information, see Table 16 and Table 20 in Annex 3.

Trends

A large majority of national forest policy statements were issued comparatively recently: more than a quarter (28 percent) of statements with known issue dates are from the last five years, and more than half of the statements date from the last decade (see Figure 8.2). In a number of countries processes to develop a forest policy are ongoing or have recently concluded. Almost twice as many countries issued forest policy statements in the 2000s compared with the 1990s. Over the last five years, on average more than ten countries have issued a national forest policy statement each year.

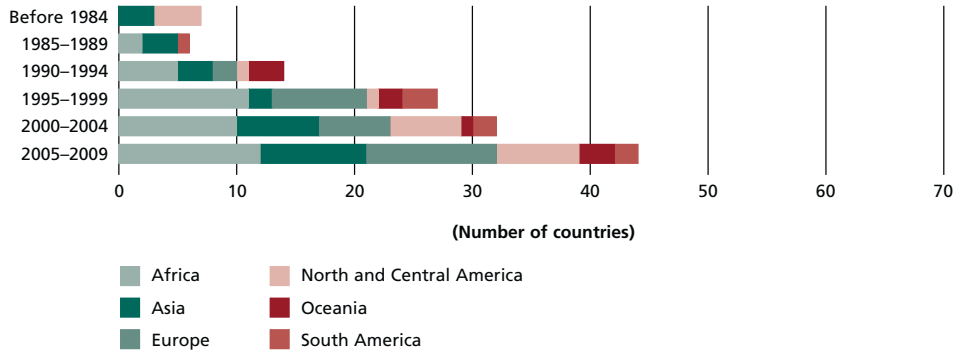
Following the international commitments made by countries in the context of the Intergovernmental Panel on Forests/Intergovernmental Forum on Forests (IPF/IFF) and later the United Nations Forum on Forests (UNFF), it appears that countries have widely adopted them in one form or another across the globe. Almost three-quarters (85 of the 115 NFPs whose starting year was reported in FRA 2010) began since 2000, and one-third began comparatively recently, since 2006. Only around one-fifth of the countries (25) reported that they started their NFP in 1999 or earlier. This indicates that an increasing number of countries have made efforts more recently to use NFPs as an approach to forest policy development and implementation.

The year of enactment of forest legislation currently in force varied widely between countries. The forest law in some countries dates back to the 1970s or earlier and changes in forest legislation in many of these countries are made through amendments

TABLE 8.1
Number of countries with a national forest policy, NFP and national forest law by region and subregion, 2008

Region/subregion	National forest policy			National forest programme			National forest law			
	Exists	Does not exist	No data	Exists	Does not exist	No data	Specific forest law	Incorporated in other law	No law	No data
Eastern and Southern Africa	15	5	3	15	5	3	17	1	2	3
Northern Africa	4	2	2	3	2	3	5	1	0	2
Western and Central Africa	21	3	2	21	1	4	21	1	1	3
Total Africa	**40**	**10**	**7**	**39**	**8**	**10**	**43**	**3**	**3**	**8**
East Asia	3	1	1	4	0	1	4	0	0	1
South and Southeast Asia	16	2	0	15	3	0	15	2	1	0
Western and Central Asia	11	8	6	11	9	5	17	1	2	5
Total Asia	**30**	**11**	**7**	**30**	**12**	**6**	**36**	**3**	**3**	**6**
Total Europe	**27**	**11**	**12**	**31**	**6**	**13**	**33**	**2**	**3**	**12**
Caribbean	10	4	13	8	6	13	10	3	2	12
Central America	6	0	1	6	0	1	6	0	0	1
North America	4	0	1	1	3	1	2	1	1	1
Total North and Central America	**20**	**4**	**15**	**15**	**9**	**15**	**18**	**4**	**3**	**14**
Total Oceania	**10**	**4**	**11**	**6**	**8**	**11**	**8**	**4**	**2**	**11**
Total South America	**8**	**6**	**0**	**10**	**4**	**0**	**12**	**1**	**1**	**0**
World	**135**	**46**	**52**	**131**	**47**	**55**	**150**	**17**	**15**	**51**

FIGURE 8.2
Date of endorsement of forest policy statement



rather than by enacting a new law. Most existing forest laws are a decade old or less. In fact, the number of countries enacting new forest legislation each year has considerably increased over the last decades. In the mid-1970s, only around two countries enacted a new forest law each year, rising to about four per year in the 1980s. Since the mid-1990s, however, every year six to eight countries have enacted new forest legislation and even more countries have amended their forest laws. Around 63 percent of countries (100 out of the 159 countries that provided data) reported that their latest amendment took place in, or after, the year 2000. For a few others, however, the latest amendment occurred in the mid-1970s. In around half of all 159 reporting countries the currently valid forest law – either enacted or amended – is from 2004 or later (see Figure 8.3). On a regional scale, on average, forest legislation is most recent in European countries, followed by Africa. In comparison, in countries of North and Central America and in Oceania current legislation averages more than a decade in age.

BOX 8.1

International conventions and agreements related to forests

A number of binding and non-binding international conventions and agreements relate to forests and their management. Among the non-binding agreements, the Non-Legally Binding Instrument on All Types of Forests, adopted by the UN General Assembly in 2007, is particularly important. Prior agreements are the Non-Legally Binding Authoritative Statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of all Types of Forests, also known as the 'Forest Principles', and 'Chapter 11 of Agenda 21: Combating Deforestation'. These both resulted from the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro, Brazil in 1992.

There are several legally-binding international conventions and agreements related to the sustainable management and conservation of forests. These international conventions and agreements rely for their impact on ratification by individual countries. Once ratified, the agreements are incorporated into the signatory countries' national legal frameworks, through which they take effect.

For the purposes of FRA 2010, the ratification status of international conventions and agreements related to forests were compiled based on information provided on their official web sites. The detailed ratification status is shown in Table 20 in Annex 3 and summarized below. The total number of countries refer to those countries that have either ratified, acceded to, approved, accepted or adopted a convention or an agreement.

Convention or agreement	Number of countries as of 1 January 2010
Non-Legally Binding Instrument on All Types of Forests	192
Convention on Biological Diversity (CBD)	192
United Nations Framework Convention on Climate Change (UNFCCC)	193
Kyoto Protocol	191
United Nations Convention on Combating Desertification (UNCCD)	192
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	175
Convention on Wetlands of International Importance (Ramsar)	160
World Heritage Convention	187
International Tropical Timber Agreement (ITTA)	60

Sources:

NLBI: http://www.un.org/en/members/

CBD: http://www.cbd.int/convention/parties/list/

UNFCCC: http://unfccc.int/parties_and_observers/parties/items/2352.php

Kyoto Protocol: http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php

UNCCD: http://www.unccd.int/convention/ratif/doeif.php

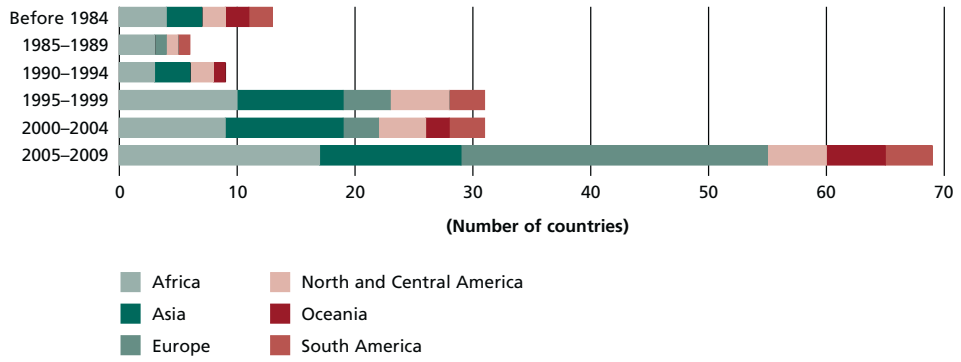
CITES: http://www.cites.org/eng/disc/parties/alphabet.shtml

Ramsar: http://www.ramsar.org/cda/en/ramsar-about-parties-contracting-parties-to-23808/main/ramsar/1-36-123%5E23808_4000_0__

World Heritage Convention: http://whc.unesco.org/en/statesparties/

ITTA: http://whc.unesco.org/en/statesparties/

FIGURE 8.3
Date of enactment of forest legislation



Conclusions

The results of FRA 2010 indicate that developing and issuing forest policy statements has become considerably more widespread over the last decade – almost equally across the countries around the globe. This is an indication that more attention is being given to developing and updating formal policies and, often, to communicating them. If properly developed and implemented, for example in the context of an NFP process, such policies provide effective strategic guidance towards sustainable forest management.

Following the commitments made in the context of the IPF/IFF, and later UNFF, countries reported that NFPs have indeed been widely taken up as a comprehensive approach to forest policy development. However, in many countries an NFP still tends to be understood as a programming document, rather than an ongoing forest policy process. Several of the NFP elements are comparatively new in forest policy processes: in particular, the strong emphasis on broad stakeholder participation and the focus on cross-sectoral coordination. Given the often major differences from traditional approaches, the progress made in adopting and integrating new elements over a short period of time varies across countries. The real added value of the NFP approach, however, accrues over time and with experience of iterative NFP cycles.

Most countries reported that they have enacted or amended their forest legislation relatively recently, enabling them to take into account the multitude of changes over the last decades and to recognize better the broad concept of sustainable forest management. If the legislation is sound and enforced this should provide a solid basis for the sustainable management of forests.

INSTITUTIONAL FRAMEWORK

Introduction

The importance of institutional structure and capacity in achieving national goals for forest management is increasingly being recognized. For the first time, in FRA 2010, countries were invited to submit information regarding their forest institutional structure, including: main responsibility for forest policy formulation; the ministry to which the national forestry agency reports; the level of subordination to the minister and human resource levels, disaggregated by gender and level of education.

Status

Countries were asked to report which ministry held the main responsibility for forest policy formulation in 2008. A total of 168 countries and areas, together accounting for

98 percent of the world's forests, replied. As can be seen in Figure 8.4, forest policy formulation was most commonly within the purview of the Ministry of Agriculture (43 percent of reporting countries). In about 33 percent of reporting countries, it was a responsibility of the Ministry of the Environment and, in about 20 percent of countries, forest policy was the responsibility of multiple ministries, the prime minister, president, or other ministries that feature neither 'agriculture' nor 'environment' in their title. This category includes countries where forest policy formulation has been entirely regionalized, with regional forestry agencies reporting to regional ministries or their equivalent (e.g. Belgium). It also includes countries where the public forestry agency is autonomous and reports directly to the president, prime minister or a board of directors (e.g. Paraguay). In 55 of the reporting countries (about one out of three) the word 'forestry' featured in the title of the ministry.

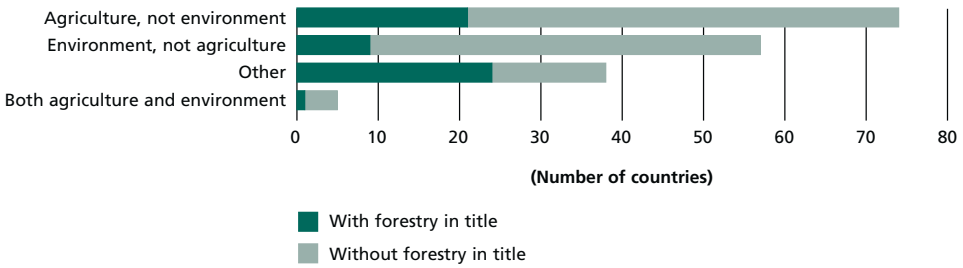
International negotiations to address climate change through a reduction in emissions from deforestation and forest degradation (REDD) pose a potential challenge to countries where interministerial coordination is not effective, since these negotiations are typically carried out by representatives of the ministry of environment, despite the fact that responsibility for taking action may fall within the ministry of agriculture and forestry. As can be seen in Figure 8.4, this is a potential risk for a significant number of countries.

A related question enquired about the level of subordination of the head of the forestry agency to the ministry. A total of 168 countries (72 percent of the total) responded to this question, representing 98 percent of the global forest area. In about a third of these countries (57) the head of the forestry agency reported directly (first level of subordination) to the minister or held a ministerial level position (as in China). These countries account for 52 percent of the total forest area. Direct reporting to the minister, however, varied greatly among regions (see Table 8.2).

Thirty-eight percent of countries (35 percent of forest area) reported at the second level of subordination (e.g. a vice-minister); 21 percent of countries (7 percent of area) reported at the third level; and 7 percent of countries (6 percent of area) reported at the fourth level of subordination. Overall, in 71 percent of responding countries (covering about 87 percent of forest area) the head of forestry reported either directly to a minister or to the next level of subordination.

Countries were also asked to report on the level of human resources within public forest institutions in 2008 (Table 8.3). This question was answered by 146 countries, representing 60 percent of the global forest area. Some large, forest-rich countries like Australia, Canada, the Democratic Republic of the Congo and the Russian Federation did not report on staff levels.

FIGURE 8.4
Ministry with main responsibility for forest policy, 2008



Most countries reported staff numbers at the national and subnational levels. However, some countries only reported a figure for national level staff (e.g. Brazil only reported staff levels for federal institutions), only for forestry officers (e.g. Thailand) or only for selected institutions (e.g. United States of America and Mexico). With the above caveats, the human resources within public forest institutions amounted to

TABLE 8.2
First level of subordination of the head of forestry to minister

Region/subregion	Information availability		Number of countries with 1st level of subordination	% of forest area with 1st level of subordination
	Number of countries	% of total forest area		
Eastern and Southern Africa	20	100.0	2	n.s.
Northern Africa	6	98.8	4	98.5
Western and Central Africa	23	96.8	6	10.6
Total Africa	**49**	**98.3**	**12**	**16.4**
East Asia	4	97.4	3	95.2
South and Southeast Asia	13	87.7	3	58.0
Western and Central Asia	18	71.5	3	20.8
Total Asia	**35**	**90.5**	**9**	**72.4**
Total Europe	**36**	**99.3**	**20**	**91.7**
Caribbean	14	83.6	5	8.9
Central America	6	93.1	4	81.3
North America	3	100.0	1	9.7
Total North and Central America	**23**	**99.6**	**10**	**11.6**
Total Oceania	**12**	**99.6**	**1**	**4.2**
Total South America	**13**	**100.0**	**5**	**65.0**
World	**168**	**98.1**	**57**	**52.0**

TABLE 8.3
Human resource levels per unit of forest area 2008 and changes between 2000 and 2008

Region/subregion	Information availability		Number of staff 2008		% of total staff with university degree (2008)	Annual change rate 2000–2008 (%)
	Number of countries	% of total forest area	Total	per 100 000 ha		
Eastern and Southern Africa	18	96.2	22 819	9	3.8	-2.6
Northern Africa	6	98.8	24 587	32	13.4	-0.1
Western and Central Africa	20	41.7	25 782	18	33.4	2.3
Total Africa	**44**	**70.0**	**73 188**	**15**	**17.0**	**n.s.**
East Asia	4	97.4	746 300	317	35.7	-1.6
South and Southeast Asia	14	89.6	306 600	114	20.1	-0.3
Western and Central Asia	13	48.1	33 498	163	33.8	-0.7
Total Asia	**31**	**89.8**	**1 086 398**	**207**	**21.8**	**-1.3**
Total Europe	**29**	**16.0**	**81 120**	**51**	**18.7**	**-1.0**
Caribbean	11	53.6	4 146	115	12.5	2.1
Central America	6	53.6	1 167	6	61.4	n.s.
North America	2	54.2	32 577	9	55.1	–
Total North and Central America	**19**	**55.4**	**37 890**	**10**	**50.6**	**1.9**
Total Oceania	**11**	**21.6**	**2 732**	**6**	**49.1**	**2.8**
Total South America	**12**	**93.1**	**5 215**	**1**	**47.4**	**2.2**
World	**146**	**59.7**	**1 286 543**	**53**	**23.2**	**-1.2**

about 1.3 million people, mostly concentrated in Asia (1.1 million), Europe (81 000) and Africa (78 000). Only about 5 000 were reportedly employed in South America.

Levels of human resources can be used to estimate the number of staff per 100 000 ha, a partial indicator of the institutional capacity to promote forest objectives. Regions exhibited large differences. Staffing levels per 100 000 ha ranged from higher than 100 in Asia and the Caribbean to lower than 10 in Central, North and South America and Oceania, with figures somewhere in the middle in Africa and Europe. This variability appears to correlate with population density, so densely populated countries have higher personnel levels per unit of forest area. When staffing levels per unit area are plotted against total forest area, there appears to be a positive correlation between the two variables meaning that more forested countries have lower human resource levels per unit area, as would be expected. The country with the highest number of staff per 100 000 ha was Egypt (9 700 or almost one staff member per 10 ha) while Venezuela had the lowest number of staff per 100 000 ha (0.17 or almost one member of staff per half a million hectares).

Fewer countries responded to the question on the number of staff in public forest institutions with a university degree. Only 119 countries (or 51 percent of the total) reported on this question for 2008, representing 35 percent of the global forest area, and information was missing for several of the larger countries. A total of about 104 000 professionals were employed in the reporting countries. On average, about one in five members of staff (23 percent) in public forest institutions had a university degree. This percentage varied from 17 percent in Africa to over 50 percent in North and Central America.

The percentage of female staff in 2008 was reported by 124 countries (or 53 percent of the total, representing 40 percent of the global forest area). Globally, countries reported that about one in five (22 percent) of total staff members were female. This percentage varied from less than 18 percent in Africa and Europe to over 30 percent in North and Central America (see Figure 8.5).

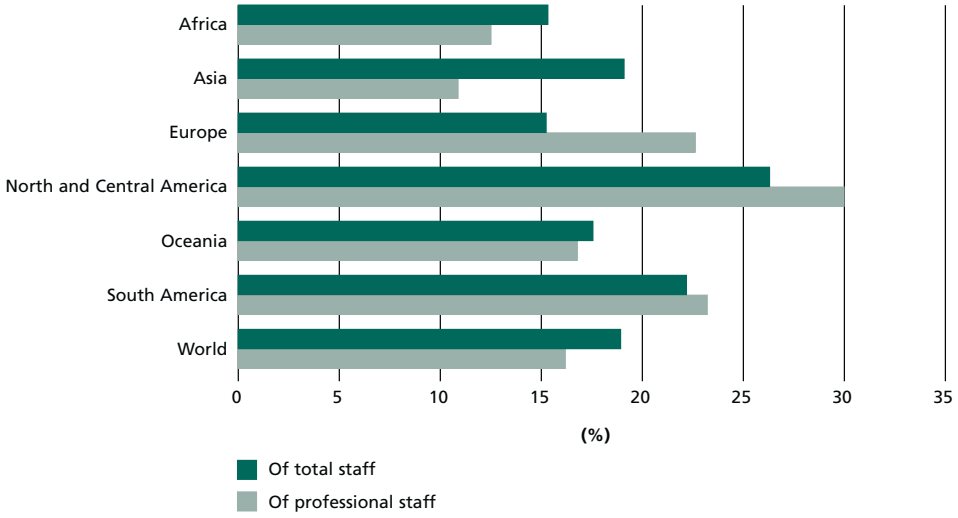
The percentage of female professional staff in 2008 was reported by 109 countries (or 47 percent of the total, representing 33 percent of the global forest area). In 2008, 19 percent of professional staff members were female. The proportion of female staff was highest among professionals in the reporting countries of North and Central America and lowest in Asia.

Trends

Staff of public forest institutions decreased globally between 2000 and 2008 by 9.1 percent, or 1.2 percent annually. These decreases were mostly concentrated in Asia and Europe. On the other hand, North, Central and South America and Oceania experienced an increase while numbers in Africa remained basically unchanged. Reported decreases may reflect a reduction in staffing levels but also a redefinition of jurisdiction, a distribution of assets to other agencies (e.g. South Africa and Mozambique), privatization of functions previously performed by public forest agencies, or structural changes (e.g. Georgia). The number of professional staff grew at an annual rate of 0.4 percent between 2000 and 2008, suggesting an increasing professionalization of public forest agencies.

Between 2000 and 2008, the proportion of female staff diminished slightly, from 23.5 percent to 22.1 percent. Indeed, this global decrease is mostly a result of reductions in the Eastern and Southern Africa and the East Asia subregions, as all other regions experienced an increase or no change in the proportion of female staff. Only 66 countries (representing 21 percent of the global forest area) reported figures that could be used to compare the percentage of professional female staff between 2000 and 2008. Globally, the percentage of women among professional staff remained basically unchanged.

FIGURE 8.5
Percentage of female staff in public forest institutions by region, 2008



Conclusions

As the role of forests in climate change mitigation becomes increasingly recognized, so does the need for improved interministerial coordination, in particular among ministries of environment and ministries of agriculture and/or forestry. This is particularly important where forest policy formulation and climate change policy are within the purview of separate ministries.

It is noteworthy that only 63 percent of countries reported figures on total human resources working in public forest institutions. Many large countries (e.g. Australia, Canada, Democratic Republic of the Congo and the Russian Federation) did not report on this variable, presumably because their decentralized institutional structures made compiling this level of information very difficult. Since this is the first time that countries have reported on such data, full comparability among them cannot be expected.

Are current staffing levels in public forest institutions appropriate to promote sustainable forest management? Unfortunately, this question cannot be easily answered because many factors contribute to overall institutional capacity including financial resources, knowledge, technology, infrastructure and equipment, partnerships and overall institutional context (e.g. policies, legal framework and other institutions). Furthermore, the appropriateness of staffing levels also depends on society's demands on forests which, in turn, are driven by demographic, geographic, environmental and climatic factors, as well as the level of economic development and national priorities.

EDUCATION AND RESEARCH

Introduction

Information about education and research provides a useful indication of a country's managerial, technical and administrative capacity for sustainable forest management and its ability to adapt the forestry sector to complex challenges such as climate change.

The number of students completing a master's degree is one indicator of the future national ability to develop and implement policies and strategies for sustainable forest management; the number of bachelor's degrees can provide an indicator of the ability to manage programmes and implement policies; and technical certificates or diplomas indicate the ability to implement operational plans. The total number

of university students who graduate with master's and bachelor's degrees may also indicate the importance society accords to forests and their management. The number of professionals working in publicly funded forest research is an indication of the national interest in, and capacity to solve, forestry sector issues, while the percentage of female students points to possible future changes in the gender balance in forestry.

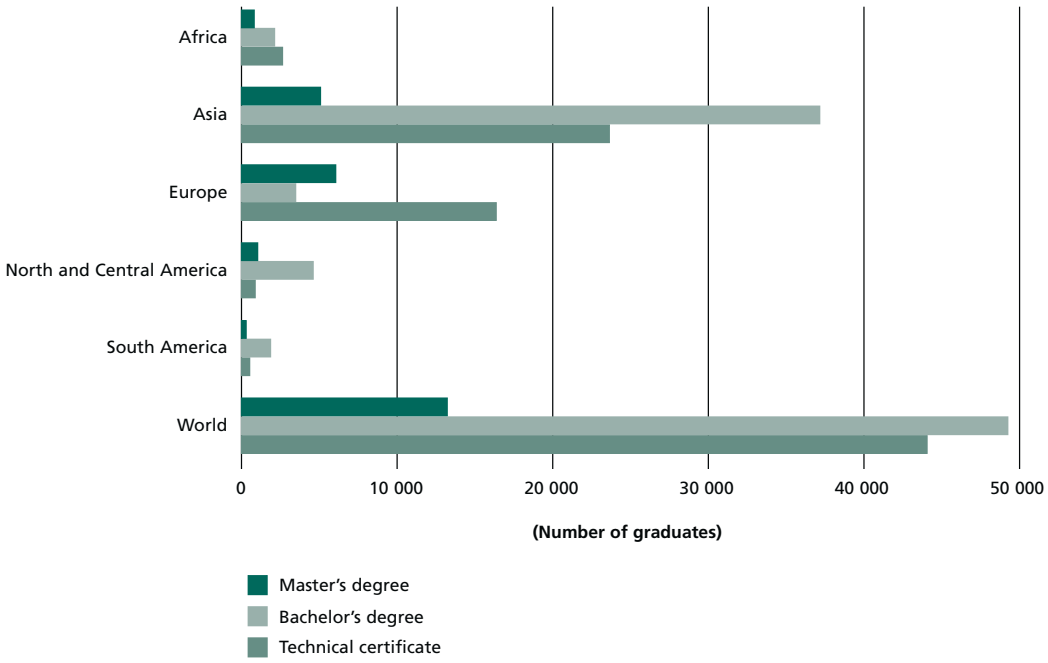
Status

In 2008, 125 countries representing more than 70 percent of the total forest cover, reported that a total of 106 800 students completed an education in forest sciences. Of these, 62 600 were university students (13 200 completing a master's degree and 49 400 a bachelor's degree) and 44 200 obtained a forest technician's certificate (see Figure 8.6).

Globally, the ratio of master's to bachelor's degrees was about one to four, but the pattern varied considerably between and within regions. For example, the low number of bachelor's degrees in Europe is partly due to the fact that the education system in many countries provides a combination of bachelor's and master's degrees in forestry, but is also a result of the lack of data for several large countries, including the Russian Federation. The lower number of technical certificates compared with bachelor's degrees is surprising. It highlights the particular difficulty of compiling data at the global level about technical certificate students focusing on forestry. Technicians often receive a broad technical education which includes forestry, agriculture and environment, and the forestry part is not necessarily mentioned in the title. The information related to master's and bachelor's degrees appears to be more coherent as it is gathered mainly from universities and faculties of forestry.

It may be assumed that a society that educates more students in forest sciences would be better prepared for future challenges related to forest conservation and

FIGURE 8.6
Graduation of students in forest-related education, 2008



Note: Oceania is not included as Australia and New Zealand did not report.

management. The readiness of the forestry sector to respond to such challenges can therefore be assessed by calculating the ratio of university educated students in forest sciences to the total population or forest area. In 2008, globally one university student graduated per 86 300 people, or one per 44 200 ha of forest. Figure 8.7 shows the number of university graduates for every 10 million people and every 10 million hectares by region. The number of graduates per 10 million hectares of forest in Asia was very high in comparison with other regions as a result of the large number of university students graduating in China.

Female students made up about 31 percent of total master's students, 36 percent of bachelor's students and 16 percent of technicians. However, some significant forest countries did not provide gender disaggregated information. Asia, North and Central America and Oceania had the highest proportions of female students in 2008, while Europe and Africa had the lowest (see Figure 8.8).

A total of 124 countries, representing 53 percent of the total forest area, reported that about 21 000 professionals were working in publicly funded research centres in 2008. Information was missing from many countries with large forest areas including Australia, Canada and the Russian Federation. About 25 percent of the total forest research workforce held a Ph.D. degree. When related to the total forest area of the reporting countries, this is equivalent to one Ph.D. per 417 000 ha of forest. Europe had by far the highest number of Ph.D. level researchers per unit of forest area (see Figure 8.9).

Trends

Between 2000 and 2008 the trend in numbers of students graduating in forest sciences was generally positive. Countries that reported on master's and bachelor's degrees represent about 50 percent of world forest area, and indicated that the number of master's students increased by about 8 percent annually and bachelor's students by 13 percent per year over the period. This increase varied between regions and subregions. Asia accounted for the largest change with an annual increase of 17 percent in master's and 16 percent in bachelor's graduates; Africa and America saw rises of between 4 and 8 percent per year in the number of master's and bachelor's students graduating in

FIGURE 8.7
Ratio of university graduates to population and forest area, 2008

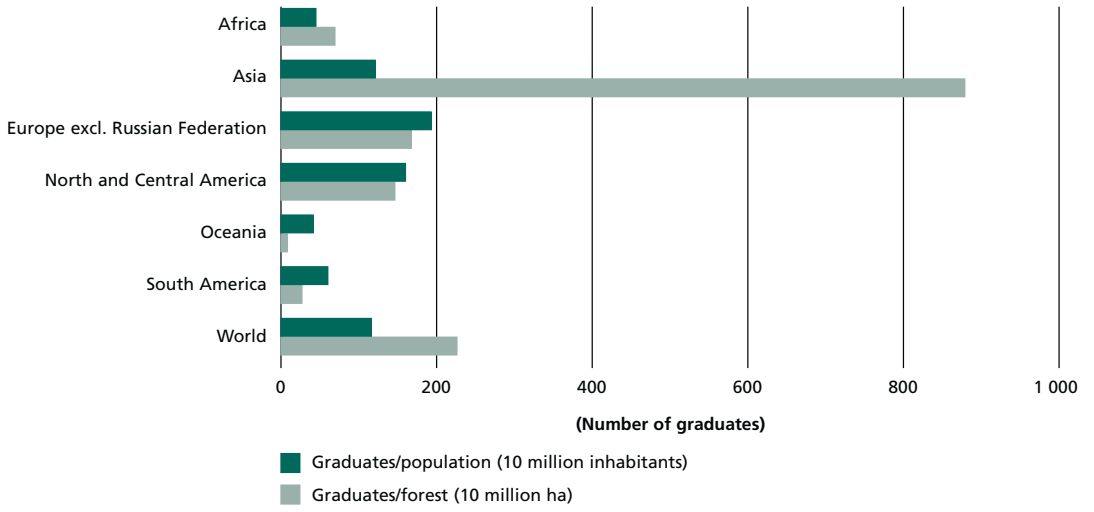


FIGURE 8.8
Percentage of female graduates in forest-related education, 2008

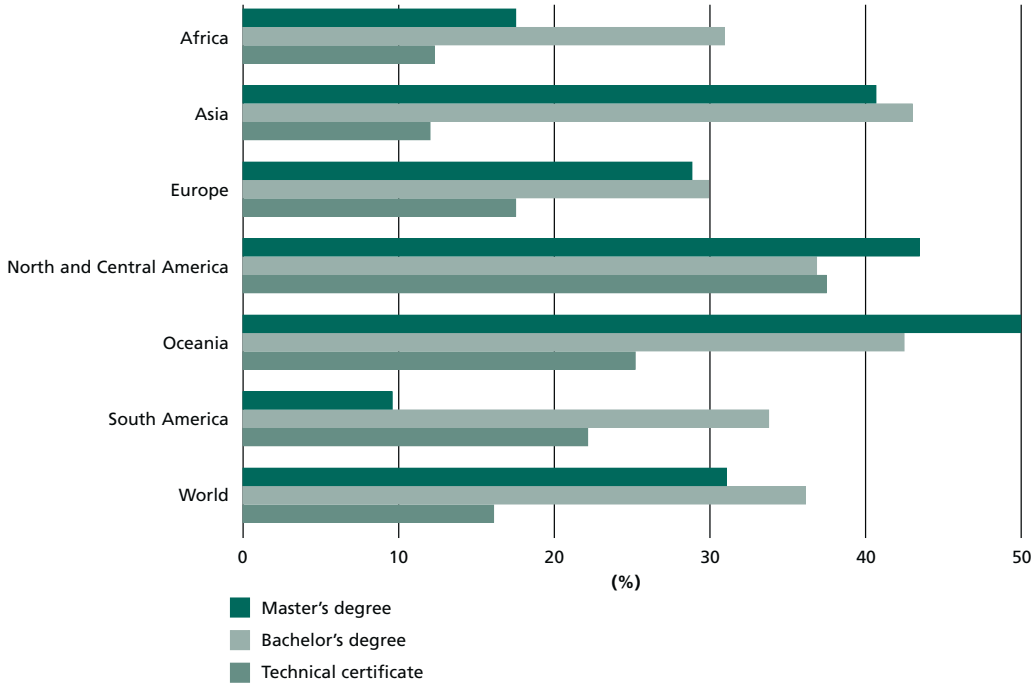
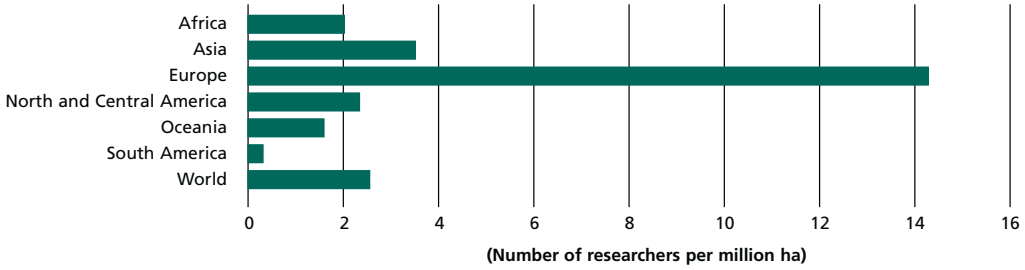


FIGURE 8.9
Number of Ph.D. researchers in public forest research institutions per million hectares of forest, 2008



Note: Several large countries, including Australia, Canada and the Russian Federation, did not report on this variable

forest sciences. Europe showed an annual increase of only 1 percent for master's and 4 percent for bachelor's degrees.

Fewer countries, representing only 33 percent of total forest area, reported on technicians and the trend was less positive at this level of education. Africa and South America showed a negative trend (-0.5 percent and -6.0 percent per annum respectively), while the United States of America showed the greatest increase with 16 percent annually.

Changing numbers of university students (master's plus bachelor's degrees) may translate into a changed potential for influencing society on current and future forest-related issues. Between 2000 and 2008, the total number of the foresters who graduated from university steadily increased for most regions by 2 to 8 percent per

year, and globally by 11.7 percent per year on average. This trend is strongly influenced by China which significantly increased the number of university students in forest sciences between 2000 and 2008.

Data from the few countries (68) that reported on the proportion of female graduates confirmed the progressive increase in the proportion of women studying forest sciences at university between 2000 and 2008. At the global level this change was about 2.1 percent annually, taking the proportion of female forestry students at university level from 30 percent in 2000 to about 34 percent in 2008.

In countries where a time series was reported the total number of Ph.D. and master's degrees held by the publicly-funded forest research workforce increased by about 2 percent per year between 2000 and 2008, while the number of research staff with bachelor's degrees increased by 1 percent annually.

Conclusions

Adequate national forest education and research capacity is essential for providing the information and knowledge needed to manage, conserve and enhance forest resources. General trends in education numbers do not suggest an imminent collapse in the profession. However, the magnitude and diversity of demands on forests and the related threats and opportunities have grown significantly in recent decades in many countries. To address these new challenges, education and research systems need to provide appropriate skills and knowledge. An assessment of whether existing capacities are appropriate is not feasible on the basis of the data reported and must be carried out at country level.

Chapter 9

Progress towards sustainable forest management

INTRODUCTION

Chapters 2 to 8 of this report focus on the results for each of the seven thematic elements of sustainable forest management. As indicated in those chapters and illustrated in Figure 9.1, forests are managed for a variety of uses and values. But how well are they managed? What does the information provided in FRA 2010 tell us about the overall progress towards sustainable forest management since 1990 at global, regional and subregional scales?

The analysis presented in this chapter focuses first on the status of forest management and then on progress towards sustainable forest management more broadly, by illustrating aggregated findings from FRA 2010 covering all seven thematic elements of sustainable forest management.

The purpose of this analysis is to shed more light on some of the complexities of sustainable forest management and stimulate additional analyses and debate, thus promoting decision-making and action for further progress.

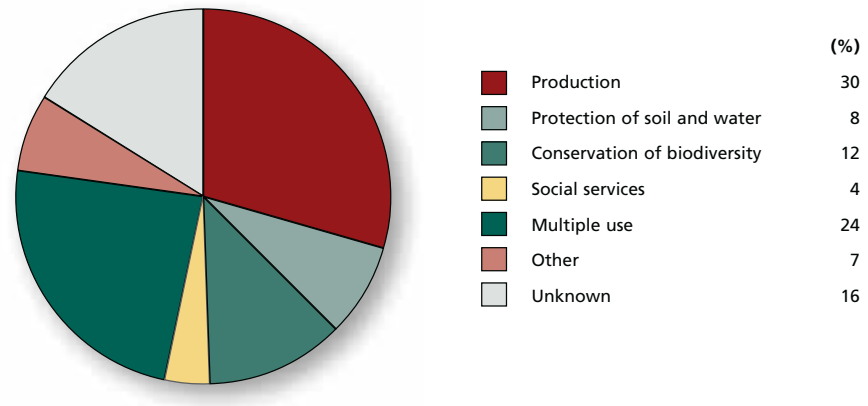
STATUS OF FOREST MANAGEMENT

In addition to reporting on the area of forest designated for specific functions, countries were asked to report on four additional variables to illustrate the status of forest management:

- the area of forest in protected areas;
- the area of permanent forest estate;
- the area of forest with a management plan;
- the area of forest under sustainable forest management.

The analysis of the data for the first variable can be found in Chapter 3 on Biological Diversity. The remaining three variables are discussed here. Country-level data can be found in Table 6 in Annex 3.

FIGURE 9.1
Designated functions of the world's forests, 2010



Area of permanent forest estate

The area of permanent forest estate indicates the area of forest designated to be retained as forest. As such, trends in this variable over time are a better indicator of progress towards sustainable forest management than trends in the total forest area in countries where certain forest areas have been set aside for future conversion to other uses (e.g. agriculture, infrastructure or urban expansion) through a transparent and technically sound decision-making process.

FRA 2010 was the first time countries were asked to report on the area of permanent forest estate and some countries clearly had difficulties identifying the equivalent designation in their national classification systems. Nevertheless, a total of 122 countries, together accounting for 84 percent of the total forest area provided information on this variable. At the global level, an estimated 52 percent of the total forest area is designated as permanent forest estate or its equivalent in 2010 (see Table 9.1).

A number of countries were unable to provide a full data series (for 1990, 2000, 2005 and 2010). However, information from 107 countries and areas (representing 77 percent of the world's forests) indicates that the permanent forest estate increased by almost 15 million hectares per year in the 1990s and close to 10 million hectares per year since 2000 (Table 9.2).

Area of forest with a management plan

The area of forest with a management plan provides another indication of progress towards sustainable forest management, although it must be noted that areas without a plan – including inaccessible areas – may also be conserved and sustainably managed, while the mere existence of a plan does not provide assurance that the plan is sound, is being implemented, or has the intended effect.

A total of 121 countries, representing 79 percent of the global forest area, reported on this variable. These reports indicate that at least 1.6 billion hectares of forest are covered by a management plan with a duration of ten years or more

TABLE 9.1
Area of permanent forest estate by region and subregion, 2010

Region/subregion	Information availability		Area of permanent forest estate	
	Number of countries	% of total forest area	1 000 ha	% of forest area
Eastern and Southern Africa	17	78.1	86 000	41.2
Northern Africa	6	98.8	67 147	86.2
Western and Central Africa	18	51.8	87 402	51.4
Total Africa	**41**	**67.7**	**240 548**	**52.7**
East Asia	3	95.3	230 908	95.1
South and Southeast Asia	8	73.9	167 533	77.0
Western and Central Asia	13	49.3	18 291	85.2
Total Asia	**24**	**81.3**	**416 732**	**86.5**
Europe excl. Russian Federation	29	69.7	120 459	88.2
Total Europe	**30**	**94.1**	**301 155**	**31.8**
Caribbean	6	51.2	3 182	89.7
Central America	1	16.7	164	5.0
North America	4	90.5	418 604	68.2
Total North and Central America	**11**	**88.0**	**421 950**	**68.0**
Total Oceania	**7**	**99.0**	**36 854**	**19.4**
Total South America	**9**	**82.2**	**349 534**	**49.2**
World	**122**	**84.4**	**1 766 774**	**51.9**

TABLE 9.2
Trends in area of permanent forest estate by region and subregion, 1990–2010

Region/ subregion	Information availability		Area of permanent forest estate (1 000 ha)				Annual change (1 000 ha)		Annual change rate (%)	
	Number of countries	% of total forest area	1990	2000	2005	2010	1990–2000	2000–2010	1990–2000	2000–2010
Eastern and Southern Africa	15	74.0	87 512	85 990	85 239	84 537	-152	-145	-0.18	-0.17
Northern Africa	6	98.8	66 851	66 940	67 056	67 147	9	21	0.01	0.03
Western and Central Africa	17	48.6	86 688	86 320	76 829	78 867	-37	-745	-0.04	-0.90
Total Africa	**38**	**64.6**	**241 050**	**239 249**	**229 123**	**230 550**	**-180**	**-870**	**-0.07**	**-0.37**
East Asia	2	85.5	169 677	188 718	204 352	217 759	1 904	2 904	1.07	1.44
South and Southeast Asia	8	73.9	180 756	171 634	169 992	167 533	-912	-410	-0.52	-0.24
Western and Central Asia	11	42.7	11 957	15 242	16 318	18 271	328	303	2.46	1.83
Total Asia	**21**	**76.6**	**362 390**	**375 594**	**390 662**	**403 563**	**1 320**	**2 797**	**0.36**	**0.72**
Europe excl. Russian Federation	27	66.8	105 451	113 334	115 534	118 484	788	515	0.72	0.45
Total Europe	**28**	**93.5**	**249 647**	**299 483**	**301 975**	**299 180**	**4 984**	**-30**	**1.84**	**-0.01**
Caribbean	4	50.4	2 356	2 731	2 993	3 165	38	43	1.49	1.48
Central America	1	16.7	0	164	164	164	16	0	-	0
North America	4	90.5	407 048	413 242	415 923	418 604	619	536	0.15	0.13
Total North and Central America	**9**	**88.0**	**409 403**	**416 138**	**419 080**	**421 933**	**673**	**580**	**0.16**	**0.14**
Total Oceania	**6**	**21.0**	**4 795**	**4 950**	**5 072**	**5 073**	**16**	**12**	**0.32**	**0.25**
Total South America	**5**	**71.8**	**133 821**	**215 435**	**258 923**	**288 415**	**8 161**	**7 298**	**4.88**	**2.96**
World	**107**	**77.1**	**1 401 106**	**1 550 849**	**1 604 835**	**1 648 715**	**14 974**	**9 787**	**1.02**	**0.61**

(Table 9.3). The true figure is undoubtedly higher as information was missing from many countries.

Information on trends over time was more limited with a full data series only available for 94 countries and areas, covering 64 percent of the world's forests. However, there was a clear increasing trend in the area of forest with a management plan in all regions and subregions over the last 20 years (see Table 9.4 and Figure 9.2). Particularly noteworthy is the rapid increase in this area over the last ten years, primarily in East Asia, sub-Saharan Africa and South America.

Area of forest under sustainable forest management

FRA 2010 is the first time countries have been asked to provide an estimate of the area of forest considered to be under sustainable forest management in the FRA process. Because there is no agreed definition or assessment methodology, this was considered a pilot assessment and countries were also asked to provide the definition, criteria and method used to assess the area under sustainable forest management. The purpose of this pilot was to obtain information on how countries might define and assess this indicator as an input to future discussions on the topic at subregional, regional and global levels, in anticipation of the need for countries to report on it as part of the assessment of progress towards the Global Objectives on Forests by 2015. Where countries did not have established assessment criteria, it was suggested that they might wish to use or adapt those applied by ITTO in its assessment of the Status of Tropical Forest Management (ITTO, 2006), which were as follows:

"Forest areas that fulfil any of the following conditions:

- have been independently certified or in which progress towards certification is being made;

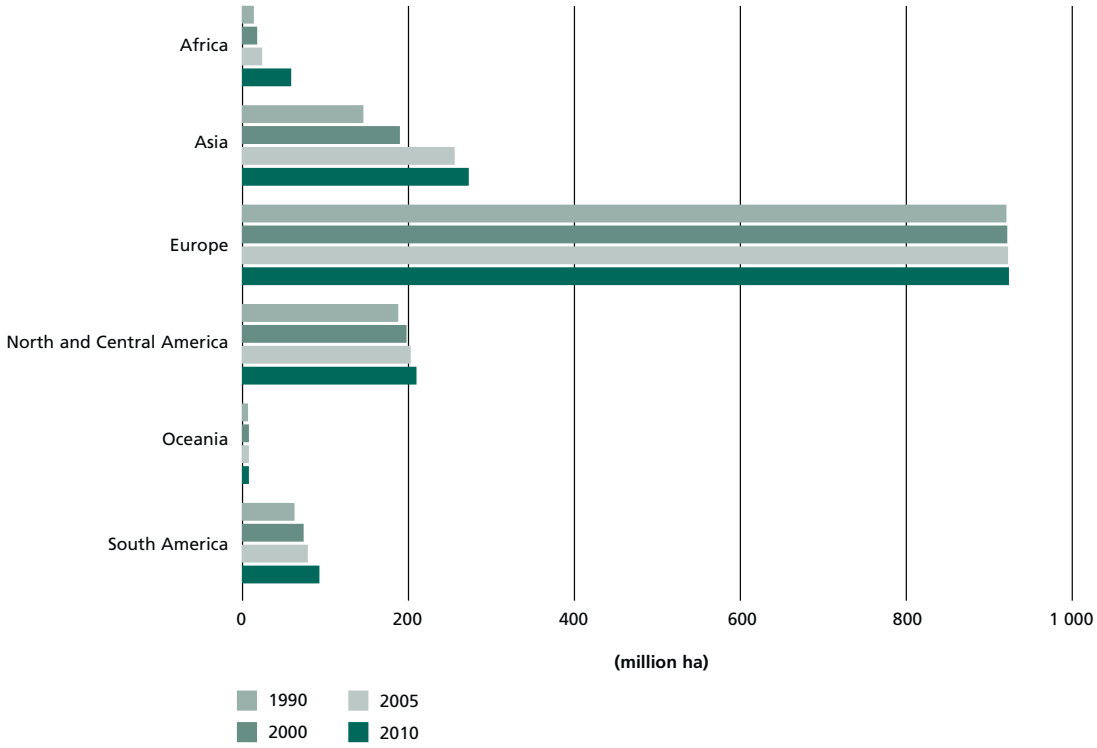
TABLE 9.3
Area of forest with a management plan by region and subregion, 2010

Region/subregion	Information availability		Area of forest with a management plan	
	Number of countries	% of total forest area	1 000 ha	% of forest area
Eastern and Southern Africa	15	86.3	45 607	19.8
Northern Africa	6	98.8	17 693	22.7
Western and Central Africa	19	96.2	42 410	13.4
Total Africa	**40**	**92.6**	**105 710**	**16.9**
East Asia	4	97.8	156 920	63.0
South and Southeast Asia	8	52.9	102 131	65.6
Western and Central Asia	11	47.2	16 017	78.0
Total Asia	**23**	**71.7**	**275 068**	**64.7**
Europe excl. Russian Federation	33	91.7	127 621	71.0
Total Europe	**34**	**98.4**	**936 711**	**94.7**
Caribbean	5	46.6	2 531	78.4
Central America	4	60.7	1 247	10.5
North America	2	44.8	206 084	67.8
Total North and Central America	**11**	**45.2**	**209 862**	**65.8**
Total Oceania	**7**	**84.0**	**38 728**	**24.1**
Total South America	**6**	**79.2**	**110 119**	**16.1**
World	**121**	**79.4**	**1 676 199**	**52.3**

TABLE 9.4
Trends in area of forest with a management plan by region and subregion, 1990–2010

Region/subregion	Information availability		Area of forest with a management plan (1 000 ha)				Annual change (1 000 ha)		Annual change rate (%)	
	Number of countries	% of total forest area	1990	2000	2005	2010	1990–2000	2000–2010	1990–2000	2000–2010
Eastern and Southern Africa	11	62.5	10 982	10 845	11 126	31 157	-14	2 031	-0.13	11.13
Northern Africa	5	10.1	1 014	1 582	2 095	2 838	57	126	4.55	6.01
Western and Central Africa	15	39.5	1 238	4 750	9 571	24 167	351	1 942	14.39	17.67
Total Africa	**31**	**45.2**	**13 234**	**17 178**	**22 793**	**58 163**	**394**	**4 098**	**2.64**	**12.97**
East Asia	4	97.8	62 687	82 200	141 800	156 920	1 951	7 472	2.75	6.68
South and Southeast Asia	6	49.8	68 574	92 134	98 239	99 010	2 356	688	3.00	0.72
Western and Central Asia	9	39.8	13 631	14 398	15 123	15 709	77	131	0.55	0.88
Total Asia	**19**	**69.7**	**144 891**	**188 731**	**255 162**	**271 639**	**4 384**	**8 291**	**2.68**	**3.71**
Europe excl. Russian Federation	29	75.3	111 368	112 156	113 415	114 054	79	190	0.07	0.17
Total Europe	**30**	**95.2**	**920 318**	**921 425**	**922 205**	**923 144**	**111**	**172**	**0.01**	**0.02**
Caribbean	2	44.7	1 974	861	1 337	2 487	-111	163	-7.96	11.19
Central America	2	18.1	87	110	86	71	2	-4	2.39	-4.31
North America	2	44.8	184 679	195 731	200 907	206 084	1 105	1 035	0.58	0.52
Total North and Central America	**6**	**44.0**	**186 740**	**196 702**	**202 330**	**208 642**	**996**	**1 194**	**0.52**	**0.59**
Total Oceania	**6**	**6.0**	**6 169**	**6 699**	**6 980**	**6 947**	**53**	**25**	**0.83**	**0.36**
Total South America	**2**	**68.0**	**62 344**	**72 605**	**78 229**	**91 970**	**1 026**	**1 937**	**1.54**	**2.39**
World	**94**	**64.1**	**1 333 696**	**1 403 340**	**1 487 698**	**1 560 504**	**6 964**	**15 716**	**0.51**	**1.07**

FIGURE 9.2
Trends in area of forest with a management plan by region, 1990–2010



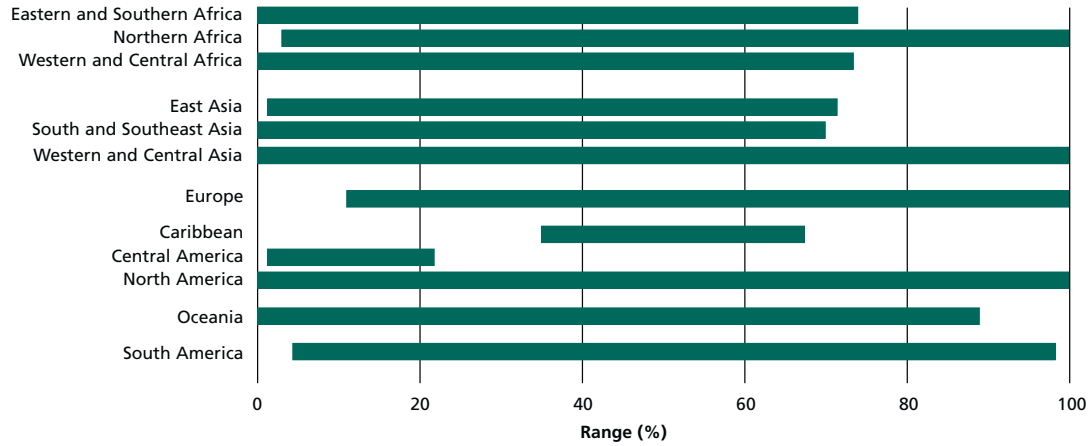
- have fully developed, long-term (ten years or more) forest management plans with firm information that these plans are being implemented effectively;
- are considered as model forest units in their country and information is available on the quality of management;
- are community-based forest management units with secure tenure for which the quality of management is known to be of high standard;
- are protected areas with secure boundaries and a management plan that are generally considered in the country and by other observers to be well managed and that are not under significant threat from destructive agents."

Although this was not an easy task, 104 countries and areas, together accounting for 62 percent of the world's forests provided estimates of the area under sustainable forest management for 2010, and 110 countries covering 81 percent of the global forest area provided an estimate for at least one point in time. Unfortunately, they did not all provide information on the definition, assessment criteria and method used.

Due to differences in definitions, it is not possible to compare the results by country or to generate regional or global totals and no attempts have been made to do so. Figure 9.3 illustrates the range in the proportion of the forest area considered to be under sustainable forest management by region. The 82 countries that provided a full data series clearly indicated a positive trend in the total forest area considered to be under sustainable forest management.

A separate publication (FAO, 2010c) provides a more detailed analysis of the definitions, assessment criteria and methods applied by countries.

FIGURE 9.3
Variation in proportion of forest area under sustainable forest management by subregion, 2010



PROGRESS TOWARDS SUSTAINABLE FOREST MANAGEMENT

To obtain a broad picture of progress towards sustainable forest management, a sub-set of indicators were selected for each of the seven thematic elements of sustainable forest management and data on trends were compiled and compared at global, regional and subregional levels across the seven themes. The results can be found in Tables 9.5 to 9.12.

Methodology

Variable selection

As a general rule, three variables were selected from the FRA 2010 reporting tables for each of the seven thematic elements, based on their relevance to the theme and information availability. No relative weighting of variables was applied. There were two exceptions to this rule: there was only one variable available for the protective functions of forest resources and only two variables were chosen for forest health and vitality because of poor information availability and incompatible data.

This yielded a total of 18 variables (see Table 9.5) selected from the 17 reporting tables. Some are derived from the variables reported by countries: for example, growing stock per hectare is derived from total growing stock and forest area.

An increase in the value of a variable is generally interpreted as making a positive contribution to the thematic element (with the exception of area of forest affected by fire and by insects) and thereby to sustainable forest management. The extent to which this assumption holds depends on local or national circumstances. For example, an increase in forest area is likely to be seen as a positive development in most countries, but where it is a result of abandonment of agricultural land and declining rural populations, it may not be seen as positive by policy-makers or society.

Three variables were selected for analysis of the extent of forest resources: area of forest, growing stock per hectare and total carbon stock in forest biomass.

There were no species or population-level indicators in FRA 2010 suitable for a global comparison of trends over time, so the biological diversity theme includes the area of primary forest, areas designated for conservation of biological diversity and area of forest in protected areas. Primary forests are usually associated with high levels of biological diversity, particularly in tropical regions, but in temperate and boreal ecosystems, primary forests can present a limited number of species and may not be a good indicator of species diversity. Yet area of primary forest is an important indicator of the status of the forest ecosystem as a whole.

Forest health and vitality is described by two variables indicating the area affected by fire and the area affected by insect pests. Within this theme, stable or decreasing values are seen as a positive contribution to sustainable forest management. It is recognized that a number of forest ecosystems are dependant on fire to maintain their vitality and regenerative capacity (particularly in boreal zones). However, fires frequently run wild and destroy large areas of forest, resulting in soil erosion and desertification – a serious threat to the sustainable management of natural resources.

Three variables represent the productive function of forest resources: the area of forest designated for productive purposes, the area of planted forests and total wood removals. This theme seeks to address the need to maintain a high and valuable supply of primary forest products, while at the same time ensuring that production and harvesting are sustainable and do not compromise the management options of future generations. Thus an increase in wood removals may not be positive in all cases, as the level of removals may not be sustainable in the long term. Planted forests are not all established and managed for productive purposes, but most of them represent a potential future source of wood.

The protective functions theme is depicted by only one variable indicating the total area of forest designated primarily for protection of soil and water.

Socio-economic functions of forests cover a wide range of benefits to humankind. The variables selected for this analysis are: level of private ownership, employment in the primary production of goods in forests and related support services and the total value of wood removals. The level of private ownership is a somewhat ambiguous variable. In some situations, an increase in this variable may be seen as a benefit for sustainable forest management, indicating devolution of management responsibility and control to individuals or communities. In other cases, it may mean that forest property rights are being transferred from the state and concentrated in the hands of relatively few individuals.

The legal, policy and institutional framework is represented by the area of forest with a management plan, the level of human resources in public forest institutions and the number of university students graduating in forestry annually.

Information availability

Many countries were unable to provide complete data for all variables or for each point in time. However, presenting data as global and regional aggregations overcomes some of the limitations in data availability on subregional scales. The extent to which countries can report on this limited set of variables also provides an indication of data availability and reporting capacity for the wider range of uses and values that societies expect of forests and a synthesis such as this can be used to expose weaknesses in data and identify those areas where information collection efforts should be targeted to improve decision-making.

Rules were created for handling gaps in data in the regions and subregions as follows. Information availability was determined as the sum of the area of forest of those countries reporting on a given variable, expressed as a percentage of total forest area in the region or subregion. It is rated high if the reporting countries together represent 75–100 percent of the total forest area, medium if the countries represent 50–74 percent and low if the percentage is 25–49 percent. If the reporting countries together account for less than 25 percent of the total forest area in the region or subregion, no findings are presented as there are insufficient data.

Data analysis and presentation of results

The country data included in the calculations are those for which countries have reported a complete time series for the variable for all reporting years.

The annual change rate for each variable is expressed as the compound change rate in percent for the periods 1990–2000 and 2000–2010, with a few exceptions. Thus the rate for each period is based on two different estimates, the accuracy of which is unknown.

An arbitrary threshold of +/-0.5 percent per year was selected for all variables in order to highlight large changes and to distinguish the cases where the difference between two estimates indicates an actual change from those cases where the difference may not be statistically significant.

Simple, three-coloured 'traffic light' matrices were prepared to visualize change rates in the variables listed under each thematic area for a particular region. These indicate trends in the selected variables over time and the progress they reflect towards sustainable forest management. Trends can thus be positive, negative or with no major change (less than 0.5 percent) for each of the 18 variables.

The results of this analysis are presented at global, regional and subregional levels.

Global results

Table 9.5 summarizes trends in the selected variables at the global level.

Extent of forest resources. The area of forest decreased by an average of 8.3 million hectares per year over the period 1990–2000 (0.20 percent per year) and by 5.2 million hectares per year in the last decade (0.13 percent per year). Forest carbon stocks show an annual decrease of about 0.5 Gt per year, while the growing stock per hectare is increasing slightly. However, none of the change rates exceed the threshold of 0.5 percent annually.

Forest biological diversity. The area of primary forest decreased by an average of 4.7 million hectares per year in the 1990s and 4.2 million hectares per year between 2000 and 2010. These figures exclude the Russian Federation, where large differences in the values over time were due to the introduction of a new classification system. On a positive note, the area of forest designated for conservation of biological diversity increased by about 6.3 million hectares per year during the last decade and a similar increase occurred in the area of forest in protected areas. In both cases the increase is equivalent to nearly 2 percent per year over the last decade.

Forest health and vitality. Both the area of forest adversely affected by fire and by insects show a decrease since 1990. However, information for this theme was missing for many countries, particularly in Africa, so the figures should be treated with caution.

Productive functions of forest resources. The area of forest designated primarily for productive purposes decreased by more than 50 million hectares between 1990 and 2010, while the area of planted forest increased by about 86 million hectares. While not all planted forests are established and used for productive purposes, these figures indicate that substantial areas of natural forests previously allocated for productive purposes are now designated for other uses, while the proportion of wood removals coming from planted forest is likely to significantly increase in the future. Wood removals decreased in the 1990s (particularly in the Russian Federation), but increased rapidly again between 2000 and 2005.

Protective functions of forest resources. The area of forest designated primarily for protection of soil and water increased by an average of 3.1 million hectares per year in the 1990s and by 2.8 million hectares per year since 2000, a total increase of 59 million hectares over the last 20 years.

Socio-economic functions of forests. The area of privately owned forests increased by an average of 4 million hectares per year in the period 1990–2000 and by 14.7 million hectares per year in the period 2000–2005. At the global level the reported value of wood removals showed no significant change between 1990 and 2000, but increased by more than 5 percent annually over the period 2000–2005. This suggests that roundwood prices recovered somewhat from their decline (in real terms) in the decade 1990–2000. However, since 2005 they have fallen sharply. Employment in the primary production of goods in forests decreased by about 1 percent per year in the 1990s, but levelled off in the period 2000–2005.

TABLE 9.5
Progress towards sustainable forest management at the global level, 1990–2010

Thematic element	FRA 2010 variables	Data availability	Annual change rate (%)		Annual change		
			1990–2000	2000–2010	1990–2000	2000–2010	Unit
Extent of forest resources	Area of forest	H	-0.20	-0.13	-8 323	-5 211	1 000 ha
	Growing stock of forests	H	0.13	0.14	n.s.	n.s.	m^3/ha
	Forest carbon stock in living biomass	H	-0.18	-0.17	-538	-502	million tonnes
Forest biological diversity	Area of primary forest	M	-0.40	-0.37	-4 666	-4 188	1 000 ha
	Area of forest designated primarily for conservation of biodiversity	H	1.14	1.92	3 250	6 334	1 000 ha
	Area of forest within protected areas	H	1.09	1.97	3 040	6 384	1 000 ha
Forest health and vitality	Area of forest affected by fire	M	-1.89	-2.15	-345	-338	1 000 ha
	Area of forest affected by insects	L	-1.88	-0.70	-699	-231	1 000 ha
Productive functions of forest resources	Area of forest designated primarily for production	H	-0.18	-0.25	-2 125	-2 911	1 000 ha
	Area of planted forest	H	1.90	2.09	3 688	4 925	1 000 ha
	Total wood removals	H	-0.50	1.08	-15 616	33 701	1 000 m^3
Protective functions of forest resources	Area of forest designated primarily for protection of soil and water	H	1.23	0.97	3 127	2 768	1 000 ha
Socio-economic functions of forests	Area of forest under private ownership	H	0.75	2.56	3 958	14 718	1 000 ha
	Value of total wood removals	M	-0.32	5.77	-241	4 713	million US$
	Employment in primary production of goods	M	-1.20	-0.11	-126	-10	1 000 FTE
Legal, policy and institutional framework	Forest area with management plan	M	0.51	1.07	6 964	15 716	1 000 ha
	Human resources in public forest institutions	L	-1.94	0.07	-23 568	830	total staff
	Number of students graduating in forestry	L	15.67	8.83	4 384	4 081	number of students

Notes: No forecasting to 2010 was done for areas affected by fire and by insects or for the amount and value of wood removals. For these variables estimates were provided for 1990 (an average of the period 1988–1992), 2000 (average of 1998–2002) and 2005 (average of 2003–2007). Data on ownership and employment were requested only for 1990, 2000 and 2005. In all these cases change rates were calculated for the periods 1990–2000 and 2000–2005. Data for human resources in public institutions and the number of forestry graduates are from 2000, 2005 and 2008; change rates are calculated for 2000–2005 and 2005–2008.

H = High (reporting countries represent 75–100% of total forest area)
M = Medium (reporting countries represent 50–74% of total forest area)
L = Low (reporting countries represent 25–49% of total forest area)

● = Positive change (greater than 0.50%)
● = No major change (between -0.50 and 0.50%)
● = Negative change (less than -0.50%)
– = Insufficient data to determine trend

Legal, policy and institutional framework. The area of forest with a management plan increased rapidly in the last ten years. However, information is missing for more than one-third of the world's forests. Human resources in public forest institutions decreased significantly between 2000 and 2005, but remained stable in the period 2005–2008. However, data availability for this variable was exceptionally poor, so the figures should be treated with caution. The number of graduates in forestry increased by more than 4 000 annually over the period 2000–2008. Again, information availability on this variable for all reporting years was relatively poor as many countries lacked information for the year 2000.

Conclusions. Overall, the situation at the global level has remained relatively stable over the last 20 years. The change in forest area is well below the threshold of 0.5 percent per year for a significant change. The largest negative rates (in percentage terms) include the decrease in the area of primary forest over the entire 20-year period; in wood removals and employment in the 1990s; and in human resources in public forest institutions during the period 2000–2005. Significant positive trends were reported in the area of forest designated for the conservation of biological diversity and the area of forest in protected areas (particularly in the last decade), the area of planted forest and the number of students graduating in forestry. Forests under private ownership and the value of wood products showed a positive trend for the period 2000–2005.

Africa

Table 9.6 summarizes trends in the selected variables for Africa.

Extent of forest resources. The area of forest decreased at an alarming rate during both periods in this region. There are indications, however, that the net loss of forests is slowing down. In the period 1990–2000 the net area change was about -4.0 million hectares per year, while in the period 2000–2010, it averaged -3.4 million hectares per year. The decrease in carbon stock was below the threshold of 0.5 percent per year. Growing stock per hectare did not change significantly, but this probably reflects the fact that few countries have more than one estimate of growing stock over time.

Forest biological diversity. The area of primary forest in Africa decreased by close to 700 000 ha annually between 1990 and 2000 and by around 572 000 ha per year in 2000–2010. However, information for this variable was missing for some countries – for example, Cameroon and the Democratic Republic of the Congo in the Congo Basin (which represents the second largest area of tropical primary forest after the Amazon Basin). Some of this decrease was caused by deforestation, some by alteration of forests through selective logging and other human interventions. This 'altered' forest area was subsequently classified as 'other naturally regenerated forest'. On a positive note, there has been an increase in the area of forest designated primarily for conservation of biological diversity of about 5 million hectares since 1990 and an even greater increase in the area of forest in protected areas. Again, information is missing from several large countries in the region, so these figures are likely to be underestimates.

Forest health and vitality. Data availability was insufficient for trend analysis for both of the variables representing this theme.

Productive functions of forest resources. There was a steady increase in wood removals from 434 million cubic metres in 1990 to 558 million cubic metres in 2005, or an annual increase of about 8 million cubic metres despite the fact that the area designated for production of wood and NWFPs has decreased by more than a million hectares per year since 1990. Most of the increase in wood removals stemmed from increased production of woodfuel, particularly in Western and Central Africa. A large part of this may have been collected from areas outside forests (other wooded land and trees outside forests) and some may have come from forests designated for multiple use – including community forests – rather than from forests designated primarily for productive purposes. The area of planted forest increased by just under 2.5 million hectares in the region over the last ten years.

Protective functions of forest resources. The area of forest designated for protection of soil and water shows a slight decrease but this is below the level of 0.5 percent change per year.

Socio-economic functions of forests. The status of the information is generally quite weak and data availability is particularly low for the value of wood removals and the level of employment. The area under private ownership declined slightly in the 1990s but increased in the period 2000–2005. However, privately owned forests still account for less than 4 percent of the total forest area. While the value of wood removals declined

TABLE 9.6
Progress towards sustainable forest management in Africa, 1990–2010

Thematic element	FRA 2010 variables	Data availability	Annual change rate (%)		Annual change		
			1990–2000	2000–2010	1990–2000	2000–2010	Unit
Extent of forest resources	Area of forest	H	-0.56	-0.49	-4 067	-3 414	1 000 ha
	Growing stock of forests	H	0.17	0.12	n.s.	n.s.	m^3/ha
	Forest carbon stock in living biomass	H	-0.44	-0.42	-262	-242	million tonnes
Forest biological diversity	Area of primary forest	M	-1.21	-1.12	-695	-572	1 000 ha
	Area of forest designated primarily for conservation of biodiversity	M	0.28	0.67	142	352	1 000 ha
	Area of forest within protected areas	M	0.54	1.10	251	555	1 000 ha
Forest health and vitality	Area of forest affected by fire	–	–	–	–	–	1 000 ha
	Area of forest affected by insects	–	–	–	–	–	1 000 ha
Productive functions of forest resources	Area of forest designated primarily for production	M	-0.40	-0.85	-825	-1 667	1 000 ha
	Area of planted forest	H	1.06	1.75	129	245	1 000 ha
	Total wood removals	H	1.81	1.45	8 549	7 767	1 000 m^3
Protective functions of forest resources	Area of forest designated primarily for protection of soil and water	M	-0.13	-0.45	-26	-91	1 000 ha
Socio-economic functions of forests	Area of forest under private ownership	H	-1.05	3.25	-243	758	1 000 ha
	Value of total wood removals	L	-1.99	6.44	-48	156	million US$
	Employment in primary production of goods	L	0.70	3.60	2	13	1 000 FTE
Legal, policy and institutional framework	Forest area with management plan	L	2.64	12.97	394	4 098	1 000 ha
	Human resources in public forest institutions	M	-1.43	2.42	-797	1 317	total staff
	Number of students graduating in forestry	M	8.11	1.01	147	23	number of students

Notes: No forecasting to 2010 was done for areas affected by fire and by insects or for the amount and value of wood removals. For these variables estimates were provided for 1990 (an average of the period 1988–1992), 2000 (average of 1998–2002) and 2005 (average of 2003–2007). Data on ownership and employment were requested only for 1990, 2000 and 2005. In all these cases change rates were calculated for the periods 1990–2000 and 2000–2005. Data for human resources in public institutions and the number of forestry graduates are from 2000, 2005 and 2008; change rates are calculated for 2000–2005 and 2005–2008.

H = High (reporting countries represent 75–100% of total forest area)
M = Medium (reporting countries represent 50–74% of total forest area)
L = Low (reporting countries represent 25–49% of total forest area)

● = Positive change (greater than 0.50%)
● = No major change (between -0.50 and 0.50%)
● = Negative change (less than -0.50%)
– = Insufficient data to determine trend

in the 1990s (despite an increase in the amount produced), it increased significantly during the period 2000–2005. The level of employment in the primary production of wood also increased during the 2000–2005 period. However, information availability for all the reporting years was below 30 percent of the total forest area for this variable.

Legal, policy and institutional framework. The area of forest with a management plan increased rapidly over the last ten years (a net increase of more than 4 million hectares annually). The level of human resources in public forest institutions decreased in the period 2000–2005 but increased again between 2005 and 2008. The number of graduates in forestry increased between 2000 and 2005 but has since levelled off.

Conclusions. On the whole, progress towards sustainable forest management in Africa has improved when comparing the last decade to the 1990s. The net loss of forest area has slowed down and the areas of forest designated for the conservation of biological diversity included in protected areas have increased slightly. The sharp increase in the area of forest with a management plan over the last ten years is particularly good news. The continued, rapid loss of forest area (the second largest of any region during this 20-year period) is, however, still a cause for concern, as is the loss of primary forests. A summary of information by subregion can be found in Table 9.12.

Asia

Table 9.7 summarizes trends in the selected variables for Asia.

Extent of forest resources. At the regional level, a net loss of forests of about 600 000 ha per year in the 1990s was reversed to form an annual net gain of 2.2 million hectares in the period 2000–2010. This was largely due to increased afforestation activity in the region, particularly in China, and despite a continued net loss of forests in South and Southeast Asia. In the period 1990–2010, the carbon stock in forest biomass decreased slightly in the region as a whole. There was, however, a large variation among the three subregions, with a net annual increase in East Asia and in Western and Central Asia and a significant decrease in South and Southeast Asia. Growing stock per hectare was largely unchanged, reflecting the fact that few countries had more than one estimate of growing stock per hectare over time. Over the last 20 years, the trend for this theme was largely stable or slightly negative, with some positive trends recently in a number of countries and some very large variations between subregions and countries.

Forest biological diversity. The area of primary forest decreased at a rate of about 340 000 ha per year during the last 10 years – almost entirely in the subregion of South and Southeast Asia. The cause of the decrease was not only deforestation but also alteration of forests through selective logging and other human interventions, which resulted in a subsequent classification of such forests as 'other naturally regenerated forest'. About 13 percent of the forest area is currently designated primarily for conservation of biological diversity, representing an average annual increase of 1.5 million hectares per year since 2000. The area of forest in protected areas has increased by a similar amount and now accounts for almost 24 percent of the total forest area of the region.

Forest health and vitality. The incidence of forest fires decreased, while the area affected by insect pests increased in the 1990s and was relatively stable in the 2000–2005 period. However, insect pests still affected a relatively small proportion of the total forest area in Asia (less than 2 percent of the 17 countries that reported on this variable).

Productive functions of forest resources. The forest area designated primarily for the production of wood and NWFPs decreased by almost 3 million hectares per year in the last decade – most of this due to a logging ban in parts of China. At the same time, the area of planted forest increased by a similar amount, the highest increase in any region. This rapid expansion took place primarily in China, where the area of planted forest increased by about 1.2 million hectares per year in the 1990s and by 2.3 million hectares per year in the period 2000–2010. Total wood removals decreased significantly during the 1990s, partly because of the logging ban in China where wood is now being imported, from both within and outside the region. However, the rate of removals increased again in South and Southeast Asia during the period 2000–2005. Several countries in the region noted that the figures for wood removals submitted do not take into account illegal removals or informal collection of woodfuel, so actual removals may be higher.

Protective functions of forest resources. The area of forest designated for protection of soil and water showed an increase over the past 20 years and grew by an average of

TABLE 9.7
Progress towards sustainable forest management in Asia, 1990–2010

Thematic element	FRA 2010 variables	Data availability	Annual change rate (%)		Annual change		
			1990–2000	2000–2010	1990–2000	2000–2010	Unit
Extent of forest resources	Area of forest	H	-0.10	0.39	-595	2 235	1 000 ha
	Growing stock of forests	H	0.34	-0.17	n.s.	n.s.	m³/ha
	Forest carbon stock in living biomass	H	-0.11	-0.31	-40	-112	million tonnes
Forest biological diversity	Area of primary forest	H	-0.43	-0.31	-504	-342	1 000 ha
	Area of forest designated primarily for conservation of biodiversity	H	0.77	2.08	471	1 461	1 000 ha
	Area of forest within protected areas	H	1.45	1.46	1 292	1 503	1 000 ha
Forest health and vitality	Area of forest affected by fire	H	-2.56	-1.53	-78	-39	1 000 ha
	Area of forest affected by insects	L	13.18	0.32	306	14	1 000 ha
Productive functions of forest resources	Area of forest designated primarily for production	H	0.26	-1.21	662	-2 945	1 000 ha
	Area of planted forest	H	2.00	2.82	1 667	2 985	1 000 ha
	Total wood removals	H	-0.64	0.18	-4 948	1 364	1 000 m³
Protective functions of forest resources	Area of forest designated primarily for protection of soil and water	H	1.75	2.18	1 741	2 638	1 000 ha
Socio-economic functions of forests	Area of forest under private ownership	H	4.79	6.27	2 930	5 572	1 000 ha
	Value of total wood removals	M	-2.97	4.36	-806	1 091	million US$
	Employment in primary production of goods	M	-0.85	-0.10	-73	-8	1 000 FTE
Legal, policy and institutional framework	Forest area with management plan	M	2.68	3.71	4 384	8 291	1 000 ha
	Human resources in public forest institutions	H	-2.14	0.16	-22 922	1 633	total staff
	Number of students graduating in forestry	M	23.89	10.80	3 856	3 522	number of students

Notes: No forecasting to 2010 was done for areas affected by fire and by insects or for the amount and value of wood removals. For these variables estimates were provided for 1990 (an average of the period 1988–1992), 2000 (average of 1998–2002) and 2005 (average of 2003–2007). Data on ownership and employment were requested only for 1990, 2000 and 2005. In all these cases change rates were calculated for the periods 1990–2000 and 2000–2005. Data for human resources in public institutions and the number of forestry graduates are from 2000, 2005 and 2008; change rates are calculated for 2000–2005 and 2005–2008

H = High (reporting countries represent 75–100% of total forest area)
M = Medium (reporting countries represent 50–74% of total forest area)
L = Low (reporting countries represent 25–49% of total forest area)

● = Positive change (greater than 0.50%)
● = No major change (between -0.50 and 0.50%)
● = Negative change (less than -0.50%)
– = Insufficient data to determine trend

2.6 million hectares per year over the last decade, reflecting greater attention to the role of forests in the conservation of soil and water, as well as other protective functions.

Socio-economic functions of forests. The area of forest under private ownership increased significantly during the period 1990–2005, particularly since 2000. China almost entirely accounted for this increase (some 5.6 million hectares per year on average between 2000 and 2005). The value of wood removals decreased in the 1990s, but between 2000 and 2005 increased at a faster rate (in percentage terms) than the volume of wood removed, indicating an increase in wood price. Employment showed a reduction in the 1990s, but is now stable.

Legal, policy and institutional framework. The area of forest with a management plan increased significantly and more than 80 million hectares were added in the last ten years. Most of this increase took place in East Asia (China in particular), while South and Southeast Asia accounted for the largest increase in forest area with a management plan in the 1990s. The level of human resources in public forest institutions decreased between 2000 and 2005 but was relatively stable between 2005 and 2008, while the number of graduates in forestry increased very rapidly in China between 2000 and 2008, strongly affecting the regional totals.

Conclusions. Overall, the forest area in Asia is about 16 million hectares larger in 2010 than it was in 1990 as a result of large-scale afforestation efforts during the last 10–15 years, particularly in China. The decrease in area of primary forest is cause for concern, while the increase in the forest area designated for conservation of biological diversity, the area of forest in protected areas and forests designated for protective functions is commendable. The area affected by fire decreased while that affected by insects increased sharply between 1990 and 2000, but then levelled off. Variables representing the legal, policy and institutional framework are largely positive or stable and information availability in the region is generally good. In short, there has been mixed progress over the last 20 years at the regional level with large variations between countries and subregions. A summary of information by subregion can be found in Table 9.12.

Europe

Table 9.8 summarizes trends in the selected variables for Europe.

Extent of forest resources. The forest area in Europe increased by an average of 776 000 ha per year over the last 20 years. The total carbon stock in forest biomass increased both as a result of the increase in forest area and because forests in Europe became more densely stocked. Average volume per hectare increased from 105 to 112 cubic metres per hectare (from 132 to 156 cubic metres per hectare if the Russian Federation is excluded, an annual increase of 1.2 cubic metres per hectare per year).

Forest biological diversity. Although the Russian Federation provided information for all four reporting years, it was excluded from the analysis of primary forest because there was a large difference in the reported change rate (from +1.6 million hectares per year in the 1990s to -0.5 million hectares per year in the period 2000–2005). This is primarily due to a change in the classification system used rather than actual changes in primary forest area. As a result, the information availability for Europe falls below the threshold of 25 percent of the total forest area, so no results are presented at the regional level for this variable. Four percent of forest area is currently designated primarily for the conservation of biological diversity. If the Russian Federation is excluded, this proportion rises to 10 percent. There has been a large increase in this area since 1990 (more than 900 000 ha per year on average). The area of forest in protected areas has also increased steadily.

Forest health and vitality. The area affected by forest fires increased between 1990 and 2000 but decreased between 2000 and 2005. A similar trend was noted for the area of forest affected by insect pests.

Productive functions of forest resources. The total volume of wood removals decreased in the 1990s. This was caused by a sharp decline in removals in the Russian Federation in the early 1990s – a result of the transition from a centrally-planned to a market-based economy. However, removals in Europe including the Russian Federation have since been moving back towards their 1990 level. The area of planted forest increased slightly over the 20-year period, while the area of forest used primarily for wood production decreased by about 33 million hectares, with corresponding gains in the areas of forest designated for multiple use, conservation and protective functions.

TABLE 9.8
Progress towards sustainable forest management in Europe, 1990–2010

Thematic element	FRA 2010 variables	Data availability	Annual change rate (%)		Annual change		
			1990–2000	2000–2010	1990–2000	2000–2010	Unit
Extent of forest resources	Area of forest	H	0.09	0.07	877	676	1 000 ha
	Growing stock of forests	H	0.28	0.32	n.s.	n.s.	m^3/ha
	Forest carbon stock in living biomass	H	0.23	0.41	100	181	million tonnes
Forest biological diversity	Area of primary forest	–	–	–	–	–	1 000 ha
	Area of forest designated primarily for conservation of biodiversity	H	4.65	2.32	1 074	759	1 000 ha
	Area of forest within protected areas	H	3.94	1.80	911	556	1 000 ha
Forest health and vitality	Area of forest affected by fire	H	4.47	-2.03	49	-27	1 000 ha
	Area of forest affected by insects	H	5.14	-9.43	285	-566	1 000 ha
Productive functions of forest resources	Area of forest designated primarily for production	H	-0.65	0.04	-3 538	195	1 000 ha
	Area of planted forest	H	1.01	0.60	627	401	1 000 ha
	Total wood removals	H	-1.92	2.76	-13 475	18 424	1 000 m^3
Protective functions of forest resources	Area of forest designated primarily for protection of soil and water	H	1.67	0.24	1 386	221	1 000 ha
Socio-economic functions of forests	Area of forest under private ownership	H	1.09	0.63	1 012	624	1 000 ha
	Value of total wood removals	–	–	–	–	–	million US$
	Employment in primary production of goods	H	-4.32	-1.36	-60	-14	1 000 FTE
Legal, policy and institutional framework	Forest area with management plan	H	0.01	0.02	111	172	1 000 ha
	Human resources in public forest institutions	–	–	–	–	–	total staff
	Number of students graduating in forestry	–	–	–	–	–	number of students

Notes: No forecasting to 2010 was done for areas affected by fire and by insects or for the amount and value of wood removals. For these variables estimates were provided for 1990 (an average of the period 1988–1992), 2000 (average of 1998–2002) and 2005 (average of 2003–2007). Data on ownership and employment were requested only for 1990, 2000 and 2005. In all these cases change rates were calculated for the periods 1990–2000 and 2000–2005. Data for human resources in public institutions and the number of forestry graduates are from 2000, 2005 and 2008; change rates are calculated for 2000–2005 and 2005–2008.

H = High (reporting countries represent 75–100% of total forest area)
M = Medium (reporting countries represent 50–74% of total forest area)
L = Low (reporting countries represent 25–49% of total forest area)

● = Positive change (greater than 0.50%)
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Protective functions of forest resources. The area of forest designated primarily for protection of soil and water increased by more than 16 million hectares during the period 1990–2010, most of this between 1990 and 2000, and now accounts for 9 percent of the total forest area in Europe.

Socio-economic functions of forests. The area of forest under private ownership increased by more than 1 million hectares per year in the 1990s but, while still increasing, the rate of change slowed down between 2000 and 2005. To a large extent this is a result of the recent privatization process in central and eastern European countries. The level of employment in the primary production of goods in forests decreased, probably due

to an increase in mechanization and organizational streamlining. There are insufficient data for an analysis of trends in the value of wood removals due to a lack of information from the Russian Federation for 1990.

Legal, policy and institutional framework. The vast majority of the forest area in Europe (95 percent) is subject to a management plan, so the increase in this variable in recent years is insignificant. The information availability is insufficient to carry out a trend analysis for the other two variables representing this theme.

Conclusions. Data availability was generally high for Europe, although results were strongly influenced by the Russian Federation. The status of forest resources in Europe has essentially been stable over the last 20 years. While the area of forest is expanding, the focus of forest management in Europe has clearly shifted away from productive functions towards conservation of biological diversity, protection and multiple uses – a shift already evident at the end of the 1990s. The main negative trends are found in employment and – when analysing figures excluding the Russian Federation – in human resources in public forest institutions between 2005 and 2008, as well as in the value of wood removals in the 1990s. Table 9.12 shows the trends for Europe including and excluding the Russian Federation.

North and Central America

Table 9.9 summarizes trends in the selected variables for North and Central America.

Extent of forest resources. Forest area for the region as a whole (705 million hectares in 2010) is almost the same as in 1990 (3 million hectares less, or 0.4 percent lower). While there was a decrease in forest area in Central America of about 6 million hectares for the period 1990–2010, the area of forest in North America increased by about 2 million hectares, mainly due to afforestation in the United States of America, and in the Caribbean by about 1 million hectares, largely as a result of natural expansion onto abandoned agricultural land, during the same period. As in Europe, the total carbon stock in forest biomass increased and the forests became more densely stocked.

Forest biological diversity. The area of primary forest has remained fairly stable overall, although there has been a significant decrease in relative (percentage) terms in Central America. The area of forest designated for conservation of biological diversity increased by more than 8 million hectares since 1990, while the area of forest in protected areas increased by more than 16 million hectares over the same period and now equals 10 percent of the total forest area of the region.

Forest health and vitality. The area adversely affected by forest fires has increased over time, while the area affected by insects decreased between 1990 and 2000, only to increase again between 2000 and 2005. North America reported the highest area of insect disturbance for 2005 of any region (some 22 million hectares or 3.4 percent of the forest area). This included major outbreaks of the mountain pine beetle (*Dendroctonus ponderosae*), which has devastated more than 11 million hectares of forest in Canada and the western United States of America since the late 1990s – an unprecedented outbreak exacerbated by higher winter temperatures.

Productive functions of forest resources. The most prominent change over time was the increase in area of forest designated primarily for productive purposes, which contrasts with the decrease in this designation in most other regions. The area of planted forest also increased, particularly in the 1990s, while total wood removals decreased by just under 3 million cubic metres per year over the last 20 years, or 0.4 percent annually.

Protective functions of forest resources. The area of forest designated for the protection of soil and water showed a significant increase in relative (percentage) terms during the last 15 years. However, in absolute terms the increase was fairly small in comparison with other variables. It should be noted that the forest areas managed for the purposes of soil and water conservation in North America are generally included

TABLE 9.9
Progress towards sustainable forest management in North and Central America, 1990–2010

Thematic element	FRA 2010 variables	Data availability	Annual change rate (%)		Annual change		
			1990–2000	2000–2010	1990–2000	2000–2010	Unit
Extent of forest resources	Area of forest	H	-0.04	n.s.	-289	-10	1 000 ha
	Growing stock of forests	H	0.24	0.69	n.s.	1	m^3/ha
	Forest carbon stock in living biomass	H	0.19	0.28	74	109	million tonnes
Forest biological diversity	Area of primary forest	H	-0.06	0.02	-167	50	1 000 ha
	Area of forest designated primarily for conservation of biodiversity	H	0.27	0.61	255	612	1 000 ha
	Area of forest within protected areas	H	0.55	2.32	284	1 361	1 000 ha
Forest health and vitality	Area of forest affected by fire	H	1.15	1.98	34	64	1 000 ha
	Area of forest affected by insects	H	-4.52	1.60	-1 246	349	1 000 ha
Productive functions of forest resources	Area of forest designated primarily for production	H	0.79	1.03	680	970	1 000 ha
	Area of planted forest	H	4.16	2.48	1 013	840	1 000 ha
	Total wood removals	H	-0.36	-0.38	-2 914	-2 982	1 000 m^3
Protective functions of forest resources	Area of forest designated primarily for protection of soil and water	H	2.07	2.21	23	30	1 000 ha
Socio-economic functions of forests	Area of forest under private ownership	H	-0.12	-0.14	-246	-273	1 000 ha
	Value of total wood removals	H	4.62	5.07	1 054	1 626	million US$
	Employment in primary production of goods	L	2.55	-0.51	3	-1	1 000 FTE
Legal, policy and institutional framework	Forest area with management plan	L	0.52	0.59	996	1 194	1 000 ha
	Human resources in public forest institutions	–	–	–	–	–	total staff
	Number of students graduating in forestry	M	2.42	8.43	98	400	number of students

Notes: No forecasting to 2010 was done for areas affected by fire and by insects or for the amount and value of wood removals. For these variables estimates were provided for 1990 (an average of the period 1988–1992), 2000 (average of 1998–2002) and 2005 (average of 2003–2007). Data on ownership and employment were requested only for 1990, 2000 and 2005. In all these cases change rates were calculated for the periods 1990–2000 and 2000–2005. Data for human resources in public institutions and the number of forestry graduates are from 2000, 2005 and 2008; change rates are calculated for 2000–2005 and 2005–2008.

H = High (reporting countries represent 75–100% of total forest area)
M = Medium (reporting countries represent 50–74% of total forest area)
L = Low (reporting countries represent 25–49% of total forest area)

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under the primary designated function of 'multiple use' rather than under 'protective function'. This influences the figures from this region as a whole.

Socio-economic functions of forests. The area of forest under private ownership decreased slightly over the last 20 years, but the annual change rate was below the threshold of 0.5 percent. The value of wood removals increased between 1990 and 2005, despite the slight decrease in the amount of wood removals indicating an increase in price. The level of employment in the primary production of goods in forests and related services showed an increase in the 1990s followed by a decrease since 2000.

Legal, policy and institutional framework. The area of forest with a management plan increased steadily over the last 20 years, adding an average of some 1 million hectares annually – primarily in the United States of America. However, information on this variable was missing from several of the larger countries in the region, including both Canada and Mexico. The number of graduates in forestry increased in both periods, while there was insufficient information on the level of human resources in public forest institutions to analyse trends over time.

Conclusions. Progress towards sustainable forest management was generally positive in North and Central America as a whole during the period 1990–2010, with the notable exception of the significant negative trends noted for the area of forest affected by fire and by insect pests and the slight decrease in the level of employment. There was, however, considerable variation among subregions, as can be seen in Table 9.12.

Oceania

Table 9.10 summarizes trends in the selected variables for Oceania.

Extent of forest resources. The area of forest was essentially stable over the period 1990–2000, but has decreased at an average rate of some 700 000 ha per year since 2000. This net loss seems to be increasing and is reported to be more than 1 million hectares per year in the last five years. This is due to large losses of forests in Australia, where severe drought and forest fires have exacerbated the loss of forest since 2000. However, as mentioned in the Country Report from Australia: "It is unclear at this stage whether the climatic-induced reduction is a temporary or permanent loss of forest." Information availability was insufficient to determine trends in the remaining two variables under this theme.

Forest biological diversity. There has been a decrease in the area of primary forest of almost 6 million hectares since 1990. Information availability was insufficient to identify trends in the area of forest designated for conservation of biological diversity and the area of forest in protected areas (1990 data were missing for Australia).

Forest health and vitality. Data availability was insufficient for trend analysis for both variables.

Productive functions of forest resources. The area of forest designated for productive purposes increased significantly in the 1990s but rose only slightly after 2000. The area of planted forest increased by more than 2 percent annually over the last 20 years but is still relatively small (4 million hectares or 2 percent of the total forest area in the region). The amount of wood removals has increased by around 1.5 million cubic metres annually since 1990.

Protective functions of forest resources. Information availability was insufficient on the area of forest designated primarily for the protection of soil and water (1990 data were missing for Australia).

Socio-economic functions of forests. The number of people employed in the primary production of forest goods and services and related activities increased slightly from 1990 to 2000 but declined slightly between 2000 and 2005. Information availability was insufficient for an analysis of the other variables.

Legal, policy and institutional framework. Data availability was insufficient for trend analysis for all three variables representing this theme.

Conclusions. Data availability is largely determined by Australia, since it accounts for 78 percent of the forest area in this region. With information missing from Australia for 1990 for many of these variables it is impossible to assess long-term trends in this region for most of the themes. The loss of primary forest and the increase in the net loss of forest area in the region are cause for concern, despite the fact that part of the latter may be a temporary loss of forest cover due to an extensive drought in Australia.

TABLE 9.10
Progress towards sustainable forest management in Oceania, 1990–2010

Thematic element	FRA 2010 variables	Data availability	Annual change rate (%)		Annual change		
			1990–2000	2000–2010	1990–2000	2000–2010	Unit
Extent of forest resources	Area of forest	H	🟡 -0.02	🟡 -0.36	-36	-700	1 000 ha
	Growing stock of forests	–	–	–	–	–	m^3/ha
	Forest carbon stock in living biomass	–	–	–	–	–	million tonnes
Forest biological diversity	Area of primary forest	H	🔴 -0.55	🔴 -0.99	-222	-370	1 000 ha
	Area of forest designated primarily for conservation of biodiversity	–	–	–	–	–	1 000 ha
	Area of forest within protected areas	–	–	–	–	–	1 000 ha
Forest health and vitality	Area of forest affected by fire	–	–	–	–	–	1 000 ha
	Area of forest affected by insects	–	–	–	–	–	1 000 ha
Productive functions of forest resources	Area of forest designated primarily for production	H	🟢 4.44	🟡 0.34	394	39	1 000 ha
	Area of planted forest	H	🟢 2.55	🟢 2.12	74	78	1 000 ha
	Total wood removals	H	🟢 3.65	🟢 2.97	1 446	1 514	1 000 m^3
Protective functions of forest resources	Area of forest designated primarily for protection of soil and water	–			–	–	1 000 ha
Socio-economic functions of forests	Area of forest under private ownership	–	–	–	–	–	1 000 ha
	Value of total wood removals	–			–	–	million US$
	Employment in primary production of goods	H	🟢 1.95	🔴 -1.53	n.s.	n.s.	1 000 FTE
Legal, policy and institutional framework	Forest area with management plan	–	–	–	–	–	1 000 ha
	Human resources in public forest institutions	–	–	–	–	–	total staff
	Number of students graduating in forestry	–	–	–	–	–	number of students

Notes: No forecasting to 2010 was done for areas affected by fire and by insects or for the amount and value of wood removals. For these variables estimates were provided for 1990 (an average of the period 1988–1992), 2000 (average of 1998–2002) and 2005 (average of 2003–2007). Data on ownership and employment were requested only for 1990, 2000 and 2005. In all these cases change rates were calculated for the periods 1990–2000 and 2000–2005. Data for human resources in public institutions and the number of forestry graduates are from 2000, 2005 and 2008; change rates are calculated for 2000–2005 and 2005–2008.

H = High (reporting countries represent 75–100% of total forest area)
M = Medium (reporting countries represent 50–74% of total forest area)
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🔴 = Negative change (less than -0.50%)
– = Insufficient data to determine trend

South America

Table 9.11 summarizes trends in the selected variables for South America.

Extent of forest resources. Forest area in South America decreased at an alarming rate in the 1990s and continued to do so in the period 2000–2010, although it did show signs of slowing down, particularly in the last five years. The annual net loss during the period 1990–2000 was 4.2 million hectares, falling to 4.0 million hectares in the period 2000–2010, the highest annual net loss of any region. It has further dropped to 3.6 million hectares annually in the last five years. It should be noted that the figures for the Amazonia in Brazil related to areas of forest cleared, without taking into account the clear-cut areas that may have regenerated and returned to

forest. Net loss for the region as a whole may thus be overestimated and was below the threshold of 0.5 percent per year for the period 1990–2010. Carbon stock in forest biomass followed the trend of total forest area, while growing stock per hectare reportedly did not change significantly – probably reflecting the fact that few countries had more than one estimate of growing stock over time.

Forest biological diversity. Primary forests currently account for 76 percent of total forest area in the region but continue to decrease rapidly by an average of around 3 million hectares per year in the period 1990–2010. Apart from deforestation, the decrease was caused by alteration of forests through selective logging and other human interventions, which resulted in a subsequent reclassification of such forests as 'other naturally regenerated forest'. On a positive note, the area of forest designated primarily for conservation of biological diversity increased by about 3.2 million hectares per year in the last ten years, or a total of 43 million hectares since 1990, while the area of forest in protected areas increased by 2.4 million hectares annually in the last ten years and now encompasses an estimated 17 percent of the total forest area in the region.

Forest health and vitality. Data availability was insufficient for trend analysis for both variables.

Productive functions of forest resources. The area of forest designated for productive functions has increased steadily by about half a million hectares annually since 1990. The area of planted forest also increased. South America reported a significant reduction in wood removals in the 1990s, from 349 million cubic metres in 1990 to 306 million cubic metres in 2000, mainly because of a reduction in the production of woodfuel. However, after 2000 removals bounced back to the level of 1990, primarily as a result of an increase in the production of industrial wood.

Protective functions of forest resources. The area of forest designated for the protection of soil and water resources remained stable over the last 20 years.

Socio-economic functions of forests. The area of forest under private ownership increased by more than 40 million hectares during the period 2000–2005, primarily as a result of changes reported by Colombia. The value of wood removals decreased in the 1990s but increased between 2000 and 2005, following the global trend. Data availability on employment was insufficient for trend analysis.

Legal, policy and institutional framework. The area of forest with a management plan continues to increase in the region – currently at a rate of 1.9 million hectares annually. The number of students graduating in forestry annually has also increased significantly since 2000. Information on human resources in public forest institutions was too limited to permit a trend analysis.

Conclusions. Overall, progress towards sustainable forest management was mixed in South America. The rate of net forest loss continues to be a cause for concern although significant progress has been made, particularly in the last five years. The rate of loss of primary forest also remains alarmingly high. Nonetheless, there were also positive signs, e.g. in the increased areas of forest designated for conservation of biological diversity and in protected areas. The decrease in removals of woodfuel may reflect a reduced demand for this product in the region, but this was partly offset by an increase in removals of industrial wood since 2000. The area of planted forests increased and may meet a larger proportion of the demand for wood in the future. The increase in the area of forest with a management plan is also a positive sign.

Subregional trends

Subregional trends were determined using the same method as that used for the regions, and following the division into subregions adopted for FRA 2010 reporting (see Chapter 1). Three regions (Africa, Asia and North and Central America) that have significant intraregional differences were divided into three subregions each. No

TABLE 9.11
Progress towards sustainable forest management in South America, 1990–2010

Thematic element	FRA 2010 variables	Data availability	Annual change rate (%)		Annual change		
			1990–2000	2000–2010	1990–2000	2000–2010	Unit
Extent of forest resources	Area of forest	H	-0.45	-0.45	-4 213	-3 997	1 000 ha
	Growing stock of forests	H	0.07	0.07	n.s.	n.s.	m³/ha
	Forest carbon stock in living biomass	H	-0.37	-0.39	-406	-404	million tonnes
Forest biological diversity	Area of primary forest	H	-0.46	-0.46	-3 096	-2 961	1 000 ha
	Area of forest designated primarily for conservation of biodiversity	H	2.59	4.83	1 187	3 167	1 000 ha
	Area of forest within protected areas	M	0.44	3.01	302	2 431	1 000 ha
Forest health and vitality	Area of forest affected by fire	–	–	–	–	–	1 000 ha
	Area of forest affected by insects	–	–	–	–	–	1 000 ha
Productive functions of forest resources	Area of forest designated primarily for production	H	0.69	0.64	501	496	1 000 ha
	Area of planted forest	H	1.97	3.23	178	376	1 000 ha
	Total wood removals	H	-1.30	2.37	-4 275	7 614	1 000 m³
Protective functions of forest resources	Area of forest designated primarily for protection of soil and water	H	n.s.	-0.02	1	-11	1 000 ha
Socio-economic functions of forests	Area of forest under private ownership	H	0.51	6.39	562	8 180	1 000 ha
	Value of total wood removals	M	-2.20	6.98	-109	352	million US$
	Employment in primary production of goods	–	–	–	–	–	1 000 FTE
Legal, policy and institutional framework	Forest area with management plan	M	1.54	2.39	1 026	1 937	1 000 ha
	Human resources in public forest institutions	–	–	–	–	–	total staff
	Number of students graduating in forestry	H	9.56	6.30	117	107	number of students

Notes: No forecasting to 2010 was done for areas affected by fire and by insects or for the amount and value of wood removals. For these variables estimates were provided for 1990 (an average of the period 1988–1992), 2000 (average of 1998–2002) and 2005 (average of 2003–2007). Data on ownership and employment were requested only for 1990, 2000 and 2005. In all these cases change rates were calculated for the periods 1990–2000 and 2000–2005. Data for human resources in public institutions and the number of forestry graduates are from 2000, 2005 and 2008; change rates are calculated for 2000–2005 and 2005–2008.

H = High (reporting countries represent 75–100% of total forest area)
M = Medium (reporting countries represent 50–74% of total forest area)
L = Low (reporting countries represent 25–49% of total forest area)

● = Positive change (greater than 0.50%)
● = No major change (between -0.50 and 0.50%)
● = Negative change (less than -0.50%)
– = Insufficient data to determine trend

subregional divisions were made of Europe, Oceania and South America, which can be considered relatively homogeneous with respect to the variables studied. The possible exception is Europe, where the Russian Federation dominates because of its size, so figures are presented for Europe as a whole, as well as for Europe excluding the Russian Federation. Table 9.12 summarizes the results for each subregion and illustrates some important intraregional differences.

In Africa, the Western and Central Africa subregion showed more positive trends than negative ones. Eastern and Southern Africa demonstrated predominantly negative trends in the 1990s but a more balanced mix for the last ten years. In Asia, East Asia

TABLE 9.12
Progress towards sustainable forest management by subregion, 1990–2010

Themes and variables	Africa								Asia		
	Eastern and Southern			Northern			Western and Central			East		
		R1	R2		R1	R2		R1	R2		R1	R2
Extent of forest resources												
Area of forest	H	●	●	H	●	●	H	●	●	H	●	●
Growing stock of forests	H	●	●	H	●	●	H	●	●	H	●	●
Forest carbon stock in living biomass	H	●	●	H	●	●	H	●	●	H	●	●
Forest biological diversity												
Area of primary forest	H	●	●	H	●	●	L	●	●	H	●	●
Area of forest designated primarily for conservation of biodiversity	H	●	●	H	●	●	M	●	●	H	●	●
Area of forest within protected areas	H	●	●	–	–	–	L	●	●	H	●	●
Forest health and vitality												
Area of forest affected by fire	L	●	●	–	–	–	–	–	–	H	●	●
Area of forest affected by insects	–	–	–	–	–	–	–	–	–	H	●	●
Productive functions of forest resources												
Area of forest designated primarily for production	H	●	●	H	●	●	M	●	●	H	●	●
Area of planted forest	H	●	●	H	●	●	H	●	●	H	●	●
Total wood removals	H	●	●	H	●	●	H	●	●	H	●	●
Protective functions of forest resources												
Area of forest designated primarily for protection of soil and water	H	●	●	H	●	●	M	●	●	H	●	●
Socio-economic functions of forests												
Area of forest under private ownership	H	●	●	H	●	●	H	●	●	H	●	●
Value of total wood removals	–	–	–	H	●	●	L	●	●	H	●	●
Employment in primary production of goods	L	●	●	–	–	–	–	–	–	H	●	●
Legal, policy and institutional framework												
Forest area with management plan	M	●	●	–	–	–	L	●	●	H	●	●
Human resources in public forest institutions	H	●	●	H	●	●	L	●	●	H	●	●
Number of students graduating in forestry	M	●	●	H	●	●	L	●	●	H	●	●

Notes:
R1 = Reference period 1: 1990–2000 with a few exceptions, see footnote to Table 9.5
R2 = Reference period 1: 2000–2010 with a few exceptions, see footnote to Table 9.5

H = High (reporting countries represent 75–100% of total forest area)
M = Medium (reporting countries represent 50–74% of total forest area)
L = Low (reporting countries represent 25–49% of total forest area)

● = Positive change (greater than 0.50%)
● = No major change (between -0.50 and 0.50%)
● = Negative change (less than -0.50%)
– = Insufficient data to determine trend

had a strong set of positive trends, but also a few that were strongly negative, while Western and Central Asia and South and Southeast Asia showed less significant changes in relative terms. South and Southeast Asia showed a clear negative trend in the extent of forest resources compared with the positive trends in the other two subregions. Europe, excluding the Russian Federation, had more positive trends for the 1990s than when the Russian Federation was included, but the opposite was true for the 2000–2010 period. The most significant intraregional difference occurred in North and Central America, where North America and the Caribbean showed a majority of positive trends, while Central America had a preponderance of negative ones.

Asia						Europe						North and Central America									Oceania			South America		
South and Southeast			Western and Central			Total Europe			Europe excl. Russian Federation			Caribbean			Central America			North America								
	R1	R2		R1	R2		R1	R2		R1	R2		R1	R2		R1	R2		R1	R2		R1	R2		R1	R2
H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	–	–	–	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	–	–	–	H	●	●
H	●	●	H	●	●	–	–	–	M	●	●	M	●	●	H	●	●	H	●	●	H	●	●	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	–	–	–	H	●	●
H	●	●	L	●	●	H	●	●	H	●	●	L	●	●	–	–	–	H	●	●	–	–	–	M	●	●
H	●	●	L	●	●	H	●	●	H	●	●	M	●	●	–	–	–	H	●	●	–	–	–	–	–	–
–	–	–	L	●	●	H	●	●	M	●	●	–	–	–	–	–	–	H	●	●	–	–	–	–	–	–
H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	H	●	●	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	H	●	●	H	●	●	H	●	●	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	H	●	●	H	●	●	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	–	–	–	H	●	●
H	●	●	H	●	●	H	●	●	H	●	●	M	●	●	L	●	●	H	●	●	–	–	–	H	●	●
M	●	●	M	●	●	–	–	–	H	●	●	L	●	●	–	–	–	H	●	●	–	–	–	M	●	●
L	●	●	M	●	●	H	●	●	M	●	●	–	–	–	L	●	●	L	●	●	H	●	●	–	–	–
L	●	●	L	●	●	H	●	●	H	●	●	L	●	●	–	–	–	L	●	●	–	–	–	M	●	●
M	●	●	L	●	●	–	–	–	M	●	●	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
L	●	●	L	●	●	–	–	–	M	●	●	L	●	●	L	●	●	M	●	●	–	–	–	H	●	●

Clearly, the division into subregions reveals trends and patterns that are not prominent on a regional scale, just as the regional breakdown highlights variations that are masked at the global scale.

Discussion

Approach and limitations

Several disclaimers must be advanced regarding the methodology and findings presented in this chapter:

- Information availability is not satisfactory for all variables, which leaves a number of gaps in the analysis.
- Selection of variables is subjective and may not be valid in other contexts or scales.
- Indications of positive or negative values for trends can be argued in several cases, particularly if the trend is seen in a bigger policy perspective.

- Indications of positive or negative trends are not presented in relation to the current status of forests and their management. For example, the positive trend in the area of forest with a management plan is more striking in Africa than in Europe, where most of the forest already had a management plan in 1990.
- Although no weights are explicitly applied in the analyses, the selection of certain variables is in itself a weighting.
- Aggregation of trends by region and subregion obscures positive or negative trends in individual countries. Results cannot therefore be seen as applicable to individual countries in any region.

The analysis is clearly sensitive to the selection of variables. The variables that could be selected were limited by the set of FRA 2010 reporting tables and further reduced by the limited information availability for several of these. It was particularly difficult to obtain information on negative aspects, such as forest degradation and illegal logging, due to a lack of common definitions and assessment methodologies. Other variables, such as progress in the revision of forest policies and legislation, did not easily fit into this type of analysis. It should also be noted that forest benefits generated in secondary production and trade were explicitly excluded from FRA 2010. Some relevant parameters were not included because of a lack of information at the global level. The list of potential variables for selection was therefore limited and the resulting selection may be somewhat skewed. In addition, there is a high covariation between some variables, which must be considered before drawing far-reaching conclusions from the findings.

The methodology used to illustrate these key trends does not take into account value judgments or variations in stakeholder perceptions of forest benefits and the relative importance of different variables. While such evaluation methodologies exist, the objectives of this chapter are to illustrate how existing information, collected as part of FRA 2010, can be used in an initial analysis of progress towards sustainable forest management and to stimulate further discussion and more detailed analyses.

In conclusion, the analyses and presentations in this chapter are limited by the variables and data available in the FRA 2010 reporting tables. Nevertheless, the results provide an overview of key trends with respect to the management and use of forest resources and should be seen as an illustration of progress, or lack of progress, towards sustainable forest management at global and regional levels. A more detailed analysis must take into consideration the variations in conditions between regions and countries.

Is there progress towards sustainable forest management?

There are many good signs and positive trends at the global level, particularly in the last ten years, but many negative trends remain at regional, subregional and national levels. While the area of planted forest and conservation efforts are on the rise, the area of primary forests continues to decline at an alarming rate as these forests come under use or are converted to other uses. As the analyses above illustrate, the answer depends on the suite of indicators selected and the scale at which they are applied. Given this and the complexity of the question, the answer cannot be definitive.

Chapter 10
Conclusions

FAO has been coordinating global forest resources assessments since 1946. FRA 2010 is the latest and the most comprehensive assessment to date. Information was collected and analysed from 233 countries and areas for four points in time: 1990, 2000, 2005 and 2010. Some 90 variables were included related to the extent, condition, uses and values of forests.

More than 900 people were involved in the FRA 2010 process, including 178 officially nominated national correspondents, their colleagues, an Advisory Group, international experts, FAO and UNECE staff, consultants and volunteers from around the world. The outcome of this process is harmonized definitions and classifications, more streamlined reporting on forests, higher quality data, a transparent reporting process and enhanced national capacity in data analysis and reporting.

This section offers general conclusions on the scope, process and results of FRA 2010. It does not repeat detailed findings from previous chapters.

SCOPE AND COVERAGE OF FRA 2010

The scope and coverage of global forest resources assessments have evolved over the past 60 years, from a timber supply orientation through a strong focus on environmental issues to a broader approach in FRA 2000 and FRA 2005. FRA 2010 continued this trend by explicitly addressing all seven thematic elements of sustainable forest management.

A critical first step in the FRA 2010 process was to select and define the global reporting variables. Following a consultative process, including a global consultation with national correspondents to FRA in Finland in June 2006 (FAO, 2006a), 17 reporting tables with about 90 variables were defined (FAO, 2007b). The tables and variables were generalized to facilitate reporting from all regions, which by necessity limits the degree of detail and emphasizes the need to consult country-specific classifications and references for more detailed analyses. At the same time, the reporting tables represented a broader coverage of forest resource parameters than in previous global assessments, for example by including information on afforestation and natural expansion of forests, and on the legal, policy and institutional framework governing the management and use of the world's forests.

Although the introduction of new tables increases the reporting burden and may result in divergent interpretations and an incomplete data set in the first round, their addition provided new insights on rates of deforestation and the significant efforts over the last ten years in many developing countries to put in place an enabling framework for sustainable forest management.

As in FRA 2005, data on deforestation rates were not directly compiled for FRA 2010 because few countries have this information. In FRA 2005 the global deforestation rate was estimated from net changes in forest area. The additional information on afforestation and natural expansion of forest for the past 20 years collected for FRA 2010 has now also made it possible to take into account deforestation within those countries that have had an overall net gain in forest area. As a result, the estimate of the global rate of deforestation and loss from natural causes for 1990–2000 of 13 million hectares per year in FRA 2005 was revised to the higher, but more accurate figure of close to 16 million hectares per year in FRA 2010. While the deforestation rate for the tropical countries for the 1990s did not change significantly as a result of

this additional information, the inclusion of countries in the temperate and boreal zone made a significant difference.

The tables on the legal, policy and institutional framework confirm that significant progress has been made in developing forest policies and laws. Some 76 countries have issued or updated their forest policy statements and 69 countries – primarily in Europe and Africa – reported that their current forest law was enacted or amended since 2005.

One important consideration in defining the tables was the availability of information at the country level. For example, while more detailed information related to protective functions of forest resources was desirable, it was not considered meaningful to request information if very few countries could respond. On the other hand, certain parameters, including NWFP values and forest fire occurrence, were considered important enough to include even if the response frequency would be low. The tables thus represent a compromise between information availability and the objective of reporting on each of the thematic elements of sustainable forest management.

The experience of linking with related reporting processes and attempting to harmonize overlapping variables was generally good. For example, further streamlining of reporting to FAO, ITTO and the Forest Europe was achieved. New variables were included in FRA 2010 to enable the assessment of progress towards the 2010 Biodiversity Target of the CBD and towards the four Global Objectives on Forests of the Non-Legally Binding Instrument on all Types of Forests adopted by the United Nations General Assembly at its 62nd Session (UNGA, 2008). Methods for reporting on variables related to forest biomass and carbon were harmonized with the latest specifications and guidelines of the IPCC (IPCC, 2006). The proportion of land area under forests, reported to FAO as part of FRA 2010, is also used as one of the indicators of progress in reaching the Millennium Development Goals. Efforts have continued to establish and maintain globally consistent definitions in the FRA process, in order to ensure consistency over time and reduce the overall reporting burden on countries.

Data availability and quality

Overall, the response rate was very good, with nine tables having information for more than 80 percent of the global forest area and all tables having more than 53 percent coverage (Figure 10.1).

However, the conclusion regarding poor information availability in earlier FRA reports is still valid: many developing countries have difficulty reporting because their national monitoring systems are inadequate both for international reporting and domestic needs. Data quality also remains an issue.

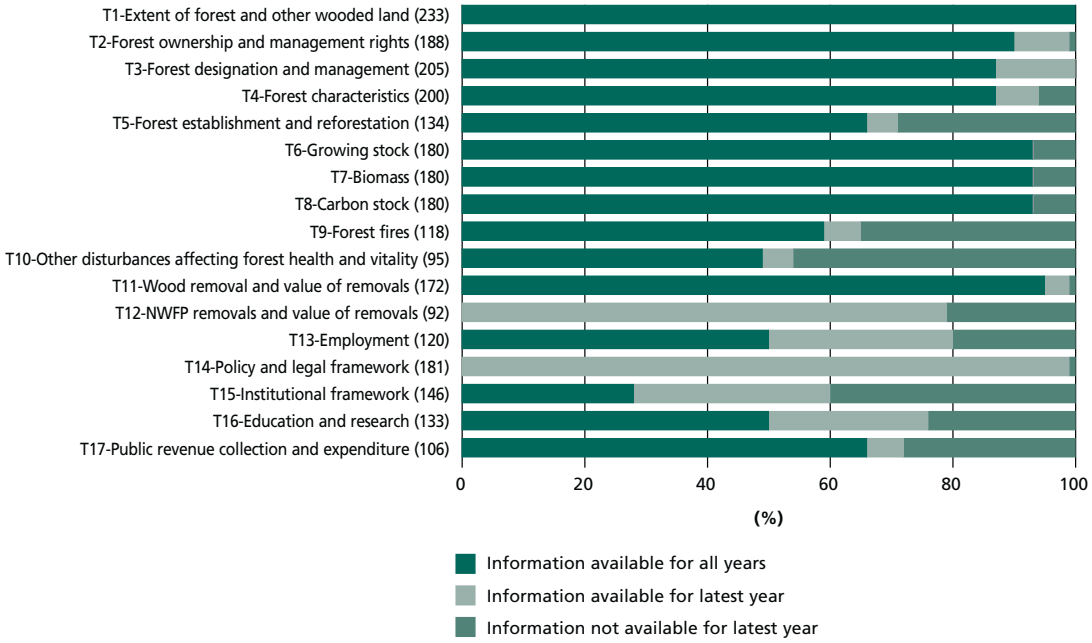
To address the issue of data availability and quality, FAO has developed a programme to support national forest assessments (see Box 10.1), and results from efforts over the last ten years are visible in a number of country reports to FRA 2010. Nevertheless, information gaps remain wide in many countries, including major forest countries.

Complementary information

A global remote sensing survey is currently being carried out for FRA 2010 to obtain more detailed and comparable information on forest change dynamics (deforestation, afforestation and natural expansion of forests) between 1990 and 2005 at global, biome and regional levels. The results are expected at the end of 2011 (see Box 2.3).

A series of special studies is also underway to provide information on specific topics where there are no agreed definitions or assessment methodologies. These studies aim to provide complementary information as well as inputs to discussions on how these aspects can be incorporated into future assessments. They include studies on forest degradation, trees outside forests, forest genetic resources, and on forests, livelihoods and poverty. Data availability is a key concern for SIDS and, even when information is available, the figures reported are often 'not significant', given the units

FIGURE 10.1
Information availability for the 17 reporting tables in FRA 2010, in relation to global forest area



Notes: No trend data were requested for NWFP removals and the existence of a policy and legal framework.
Numbers in () are number of countries that provided data for the latest reporting year.

of measurements necessary to include information from the large forested countries. A special study aims to address both of these issues (see Box 10.2).

THE FRA 2010 PROCESS

The active, direct involvement of countries was a defining characteristic of FRA 2005. FRA 2010 continued and expanded this process by strengthening the collaboration with other forest-related organizations and reporting processes.

FAO, with the support of donors, invested considerable resources in establishing a network of national correspondents and organizing global and regional meetings to support the reporting process and build capacity. Countries readily provided the expertise and resources needed to participate and the network currently numbers 178 officially nominated national correspondents and a large number of alternates, representatives of forest-related organizations and individual resource assessment specialists. While demanding of resources, the network of national correspondents was a critical success factor for FRA 2010.

As in FRA 2005, the information from each country is documented in a national report in either English, French or Spanish, following a standard outline. To help those countries from which limited new information was expected, FAO pre-filled the FRA 2010 reports with the information provided for FRA 2005. This significantly reduced the workload involved in the documentation of information sources and original data. However, where new information was available, substantial efforts were needed by the national correspondents to document each step in the transformation of national data to the FRA 2010 reporting tables. These efforts involved extensive knowledge-sharing through discussions at regional workshops, and between countries and the regional focal points at FAO headquarters.

BOX 10.1

FAO's support to national forest monitoring and assessment

The National Forest Monitoring and Assessment (NFMA) programme at FAO is developing cost-effective methodologies that include both remote sensing techniques and systematic field data collections to assess and monitor the multiple benefits from forests (and other natural resources) at the country level, in order to support national policy processes.

Over the last decade, the NFMA programme has collaborated with more than 20 countries around the world to strengthen their capacities to establish and manage systems for national forest monitoring and assessment and to carry out national forest inventories. This forestry information supports national level planning and policy formulation in a broad context, which includes, for example, forest management, law enforcement, monitoring and evaluation, poverty monitoring, land use planning and administration, investment opportunities, research, training, advice and outreach, and determination of forests' contributions to GDP. While forests and forestry (including wood production and commercial values, as well as other benefits and beneficiaries of forest resources) are at the centre of the NFMA, strong links are established with related sectors, such as agriculture, water resources, rangelands and energy.

The programme helps countries to produce national level data on a vast number of variables. These include variables needed to calculate growing stock, biomass and carbon (stem diameter, tree height, deadwood biomass, soil carbon and litter); vegetation type (including species composition and naturalness); extent of land use and land cover, biodiversity status, land use history, human disturbances, management practices and conservation status. The inventory covers measurements of trees outside forests, making it possible to estimate above-ground biomass outside forests and to value the multiple functions of trees. Data are also collected on factors that may help in determining the best mechanisms for mitigating deforestation and forest degradation, such as ownership, access to input markets, consumption levels of forest products, potential revenues accrued from forest resources and crop production systems.

NFMA-generated data respond to the needs of both national and international users. National users comprise policy-makers from ministries of agriculture, land, forestry, finance and statistics, as well as universities, research institutes and civil society organizations. International users include international reporting processes, conventions and others, such as the Global Forest Resources Assessment, the CBD, the Millennium Development Goals, ITTO, UNFCCC, as well as universities and research organizations around the world.

The NFMA programme relies on a wide network of experts and specialists who provide technical and strategic guidance, and actively promotes south–south collaboration and knowledge sharing. While the programme provides technical assistance to countries, the actual implementation is carried out by national institutions and national staff to enable strong country ownership of the process as well as replicability and institutional strengthening for long-term forestry monitoring. The programme aims to harmonize methods in order to improve technical collaboration between countries and to facilitate reporting to international processes.

FAO works actively with countries and forest-related organizations to identify and address information gaps for continuous improvement of knowledge about forests and forestry. The FRA process enhances country reporting capacity through training and feedback on national reports. In response to specific country requests, FAO also provides technical support to implement and improve national forest monitoring and assessment systems, for new and better information (see Box 10.1).

BOX 10.2

Special study on Small Island Developing States

The Global Forest Resources Assessment 2010 shows that the data reported by many SIDS are inadequate to determine trends for the majority of the variables. A lack of resources and limited technical capacity for forest resource monitoring in many SIDS means that they have some of the poorest forest data in the world, suffering from gaps, inconsistent quality and old age.

In addition, many SIDS have expressed concern that the data they report for the Global Forest Resources Assessments are not visible, because of the small size of these countries relative to the size of the reporting units. Recommendations have been made in several meetings for a special study on SIDS.

The combined forest cover of SIDS is considered insignificant in global terms (representing less than 1 percent of the forest area of the world). However, forests and trees play a crucial role in the social and economic development of SIDS. In addition, they provide environmental services (e.g. soil and water protection, tourism and carbon sequestration) and many of the island habitats have global significance in terms of conservation of biological diversity, particularly of endemic species.

It is clear from FAO's work globally that better information can lead to better informed decisions. Working in partnership with the officially nominated FRA National Correspondents and the Secretariat of the Pacific Community, FAO will conduct a special study of forests and forest resources in SIDS. This study will lead to benefits through improved forest resource information feeding into broader social, economic and environmental policies and strategies in SIDS. It aims to draw attention to forests, forest management and specific forest-related issues in SIDS and (funding permitting) will:

- increase awareness of the role of forests and trees in SIDS;
- examine the current status, trends and management of forest resources;
- evaluate constraints and opportunities for sustainable forest management;
- examine drivers of deforestation;
- enhance capacity building and regional networks;
- develop base land cover maps;
- develop ways to map forest cover change and information on land use dynamics.

The special study follows recommendations made by the officially nominated National Correspondents to the FRA reporting process. The project will be spearheaded by FAO and carried out in partnership with countries and existing forest-related organizations to ensure a coordinated approach to capacity building.

While there are common issues for SIDS, there are also differences related to the size of each country. These are due to variations in population size and density, remoteness, distance to markets and access to resources. The study is expected to highlight common issues among SIDS and identify differences (and similarities) between specific sub-groups (e.g. large, medium and small countries).

PROGRESS TOWARDS SUSTAINABLE FOREST MANAGEMENT

Using the thematic elements of sustainable forest management as a framework for FRA 2010 has helped further increase the utility of the global forest resources assessments. In addition to providing information on traditional variables such forest area change and deforestation (the first thematic element of sustainable forest management), FRA 2010 also includes detailed information on key aspects related to forest biological diversity, forest health, the productive, protective and socio-economic functions of forests, and the legal, policy and institutional framework guiding their management and use. The result is a much richer review of key trends in forest resources, their functions and benefits.

It is clear from the findings of FRA 2010 that there is mixed progress towards sustainable forest management. While many trends remain alarming, there are also many positive developments over the last 20 years.

When interpreting the findings from FRA 2010, the scale is crucial. At the global level, the world's forest resources appear to be fairly stable (Chapter 9, Table 9.5): changes in most variables are relatively small and the large changes indicate more positive than negative trends. However, this picture changes dramatically when the information is broken down by region and subregion (Tables 9.6–9.12 in the same chapter), revealing considerable differences, with alarming trends in several tropical subregions. The country reports suggest that the variations are even greater at national and subnational scales, but it is not the purpose of this report to draw conclusions at these levels.

All regions and subregions display a mixture of positive and negative trends, which makes it difficult to say anything definite about the level of progress towards sustainable forest management. The FRA process and this report do not attempt to weight the variables, which would imply that one trend is more important than another, nor is an assessment of progress towards sustainable forest management at the country level included. This would need to be the subject of further analyses by, for example, national forest programmes or other policy or planning processes.

The global forest resources assessment process delivers observed trends of key parameters related to forestry and the forest ecosystem. The FRA process does not include scenario development. By contrast, the FAO-led *Forestry Outlook Studies* (FAO, 2009d), the *Millennium Ecosystem Assessment* (MEA, 2005) and the *Global Environmental Outlook 4* (UNEP, 2007) are examples of processes that make good use of the knowledge generated by the FRA process to predict future scenarios. The FRA report does, however, illustrate recent positive and negative trends at global, regional and subregional levels, which hopefully will stimulate a healthy debate and further analysis of the overall performance of the forestry sector.

Alarming trends

The key findings of FRA 2010 highlight a number of observations that are alarming in the light of aspirations for sustainable forest management and for progress towards the 2010 Biodiversity Target and the four Global Objectives on Forests:

- Deforestation and natural loss of forest continues at an alarming rate in several regions and countries.
- The area of primary forest is decreasing by about 4 million hectares each year. This is partly a result of deforestation and partly due to selective logging and other human activities that leave visible signs of human impact and thus transform the forest into 'other naturally regenerated forest' in the FRA 2010 classification system.
- In some regions, the area of forest adversely affected by drought and by insect pests is increasing.
- Employment in forest establishment, management and use declined by about 10 percent globally between 1990 and 2005.
- The value of wood removals fell in the 1990s, rose between 2000 and 2005, but has since fallen sharply again.

Although the above trends are not universally perceived as negative (a decrease in the level of employment could be due to increased labour productivity and may result in decreased production costs), substantial efforts are needed to address a number of alarming trends and advance progress towards sustainable forest management in all countries and regions. National forest programmes offer a potential vehicle for the discussion of issues and for reaching agreements on priority actions at the national and subnational levels.

Positive news

However, there is also some very positive news:

- The rate of deforestation is showing signs of slowing down at the global level and significant progress has been made in some countries to reduce the rate of forest loss in the last 5–10 years.
- The area of forest designated for conservation of biological diversity has increased by more than 95 million hectares since 1990. These forests now account for more than 460 million hectares. Most, but not all, of them are located inside legally established protected areas, which now account for an estimated 13 percent of the world's forests.
- The area of planted forest increased by about 5 million hectares per year during the period 2000–2010 and, although only accounting for 7 percent of the total forest area, planted forests supply an increasing share of the demand for wood.
- The area of forest designated primarily for the protection of soil and water increased by 59 million hectares between 1990 and 2010 and now accounts for 8 percent of the total forest area.
- Significant progress has been made in further developing an enabling framework for sustainable forest management. A large number of forest policies and laws have been created or updated; close to 75 percent of the world's forests are now covered by national forest programmes; and the area of forest with a management plan has increased significantly in sub-Saharan Africa and South America.

Forests and climate change – a window of opportunity

Among other functions, forests play a crucial role in climate change mitigation and adaptation. One of the positive messages from FRA 2010 is that carbon emissions from forests have been reduced in recent years as a result of the decrease in the rate of deforestation combined with large-scale planting of new forests.

There is now unprecedented awareness of the role forests play in climate change mitigation. The recent discussions under the UNFCCC to establish a mechanism to reward developing countries that reduce their carbon emissions from deforestation and forest degradation (REDD-plus) and the additional funding already pledged will, it is hoped, help further reduce the rates of deforestation and forest degradation in many countries.

NEXT STEPS

Members of the Collaborative Partnership on Forests, regional groups, non-governmental organizations and countries worked together in the design and implementation of FRA 2010. Joint planning for the next global assessment (FRA 2015) will commence in 2011, based on an in-depth evaluation of FRA 2010.

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INTERNATIONAL ORGANIZATIONS AND INSTITUTIONS

Amazon Cooperation Treaty Organization (ACTO); Convention on Biological Diversity (CBD); Dry Forests Asia Process; European Forestry Institute (EFI); Finnish Forest Research Institute (Metla); Joint Research Centre of the European Commission (JRC); International Network for Bamboo and Rattan (INBAR); International Tropical Timber Organization (ITTO); International Union for Conservation of Nature (IUCN); International Union of Forest Research Organizations (IUFRO); Ministerial Conference on the Protection of Forests in Europe (MCPFE – now Forest Europe); Montréal Process (Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests); South Dakota State University, United States of America (SDSU); Tarapoto Process; United Nations Economic Commission for Europe (UNECE); United Nations Environment Programme (UNEP); United Nations Forum on Forests (UNFF); United Nations Framework Convention on Climate Change (UNFCCC); World Bank (WB); United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC); World Agroforestry Centre (ICRAF); World Resources Institute (WRI).

Annex 2

Terms and definitions used in FRA 2010

EXTENT OF FOREST AND OTHER WOODED LAND

Category	Definition
Forest	Land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use.
Other wooded land	Land not classified as "Forest", spanning more than 0.5 hectares; with trees higher than 5 meters and a canopy cover of 5–10 percent, or trees able to reach these thresholds *in situ*; or with a combined cover of shrubs, bushes and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.
Other land	All land that is not classified as "Forest" or "Other wooded land".
Other land with tree cover *(sub-category of "Other land")*	Land classified as "Other land", spanning more than 0.5 hectares with a canopy cover of more than 10 percent of trees able to reach a height of 5 meters at maturity.
Inland water bodies	Inland water bodies generally include major rivers, lakes and water reservoirs.

FOREST OWNERSHIP

Term	Definition
Forest ownership	Generally refers to the legal right to freely and exclusively use, control, transfer, or otherwise benefit from a forest. Ownership can be acquired through transfers such as sales, donations, and inheritance.
Management rights of public forests	Refers to the right to manage and use publicly owned forests for a specific period of time.

Category	Definition
Public ownership	Forest owned by the State; or administrative units of the Public Administration; or by institutions or corporations owned by the Public Administration.
Private ownership	Forest owned by individuals, families, communities, private co-operatives, corporations and other business entities, private religious and educational institutions, pension or investment funds, NGOs, nature conservation associations and other private institutions.
Individuals *(sub-category of Private ownership)*	Forest owned by individuals and families.

Private business entities and institutions *(sub-category of Private ownership)*	Forest owned by private corporations, co-operatives, companies and other business entities, as well as private organizations such as NGOs, nature conservation associations, and private religious and educational institutions, etc.
Local communities *(sub-category of Private ownership)*	Forest owned by a group of individuals belonging to the same community residing within or in the vicinity of a forest area. The community members are co-owners that share exclusive rights and duties, and benefits contribute to the community development.
Indigenous / tribal communities *(sub-category of Private ownership)*	Forest owned by communities of indigenous or tribal people.
Other types of ownership	Other kinds of ownership arrangements not covered by the categories above. Also includes areas where ownership is unclear or disputed.

CATEGORIES RELATED TO THE HOLDER OF MANAGEMENT RIGHTS OF PUBLIC FOREST RESOURCES

Public administration	The public administration (or institutions or corporations owned by the public administration) retains management rights and responsibilities within the limits specified by the legislation.
Individuals/ households	Forest management rights and responsibilities are transferred from the public administration to individuals or households through long-term leases or management agreements.
Private institutions	Forest management rights and responsibilities are transferred from the public administration to corporations, other business entities, private co-operatives, private non-profit institutions and associations, etc., through long-term leases or management agreements.
Communities	Forest management rights and responsibilities are transferred from the public administration to local communities (including indigenous and tribal communities) through long-term leases or management agreements.
Other form of management rights	Forests for which the transfer of management rights does not belong to any of the categories mentioned above.

FOREST DESIGNATION

Term	Definition
Primary designated function	The primary function or management objective assigned to a management unit either by legal prescription, documented decision of the landowner/ manager, or evidence provided by documented studies of forest management practices and customary use.
Protected areas	Areas especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

Category	Definition
Production	Forest area designated primarily for production of wood, fibre, bio-energy and/or non-wood forest products.
Protection of soil and water	Forest area designated primarily for protection of soil and water.
Conservation of biodiversity	Forest area designated primarily for conservation of biological diversity. Includes but is not limited to areas designated for biodiversity conservation within the protected areas.
Social services	Forest area designated primarily for social services.
Multiple use	Forest area designated primarily for more than one purpose and where none of these alone is considered as the predominant designated function.
Other	Forest areas designated primarily for a function other than production, protection, conservation, social services or multiple use.
No/unknown	No or unknown designation.

SPECIAL DESIGNATION AND MANAGEMENT CATEGORIES

Area of permanent forest estate (PFE)	Forest area that is designated to be retained as forest and may not be converted to other land use.
Forest area within protected areas	Forest area within formally established protected areas independently of the purpose for which the protected areas were established.
Forest area under sustainable forest management	To be defined and documented by the country.
Forest area with management plan	Forest area that has a long-term (ten years or more) documented management plan, aiming at defined management goals, which is periodically revised.

FOREST CHARACTERISTICS

Term	Definition
Naturally regenerated forest	Forest predominantly composed of trees established through natural regeneration.
Introduced species	A species, subspecies or lower taxon, occurring outside its natural range (past or present) and dispersal potential (i.e. outside the range it occupies naturally or could occupy without direct or indirect introduction or care by humans).

Category	Definition
Primary forest	Naturally regenerated forest of native species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.
Other naturally regenerated forest	Naturally regenerated forest where there are clearly visible indications of human activities.

Other naturally regenerated forest of introduced species *(sub-category)*	Other naturally regenerated forest where the trees are predominantly of introduced species.
Planted forest	Forest predominantly composed of trees established through planting and/or deliberate seeding.
Planted forest of introduced species *(sub-category)*	Planted forest, where the planted/seeded trees are predominantly of introduced species.

SPECIAL CATEGORIES

Category	Definition
Rubber plantations	Forest area with rubber tree plantations.
Mangroves	Area of forest and other wooded land with mangrove vegetation.
Bamboo	Area of forest and other wooded land with predominant bamboo vegetation.

FOREST ESTABLISHMENT AND REFORESTATION

Term	Definition
Afforestation	Establishment of forest through planting and/or deliberate seeding on land that, until then, was not classified as forest.
Reforestation	Re-establishment of forest through planting and/or deliberate seeding on land classified as forest.
Natural expansion of forest	Expansion of forests through natural succession on land that, until then, was under another land use (e.g. forest succession on land previously used for agriculture).

GROWING STOCK

Category	Definition
Growing stock	Volume over bark of all living trees more than X cm in diameter at breast height (or above buttress if these are higher). Includes the stem from ground level or stump height up to a top diameter of Y cm, and may also include branches to a minimum diameter of W cm.
Growing stock of commercial species	Growing stock (see def. above) of commercial species.

BIOMASS STOCK

Category	Definition
Above-ground biomass	All living biomass above the soil including stem, stump, branches, bark, seeds, and foliage.

Below-ground biomass	All biomass of live roots. Fine roots of less than 2mm diameter are excluded because these often cannot be distinguished empirically from soil organic matter or litter.
Dead wood	All non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country.

CARBON STOCK

Category	Definition
Carbon in above-ground biomass	Carbon in all living biomass above the soil, including stem, stump, branches, bark, seeds, and foliage.
Carbon in below-ground biomass	Carbon in all biomass of live roots. Fine roots of less than 2 mm diameter are excluded, because these often cannot be distinguished empirically from soil organic matter or litter.
Carbon in dead wood	Carbon in all non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil. Dead wood includes wood lying on the surface, dead roots, and stumps larger than or equal to 10 cm in diameter or any other diameter used by the country.
Carbon in litter	Carbon in all non-living biomass with a diameter less than the minimum diameter for dead wood (e.g. 10 cm), lying dead in various states of decomposition above the mineral or organic soil.
Soil carbon	Organic carbon in mineral and organic soils (including peat) to a specified depth chosen by the country and applied consistently through the time series.

FOREST FIRES

Category	Definition
Number of fires	Number of vegetation fires per year.
Area affected by fire	Area affected by vegetation fires per year.
Vegetation fire *(supplementary term)*	Any vegetation fire regardless of ignition source, damage or benefit.
Wildfire	Any unplanned and/or uncontrolled vegetation fire.
Planned fire	A vegetation fire regardless of ignition source that burns according to management objectives and requires limited or no suppression action.

DISTURBANCES AFFECTING FOREST HEALTH AND VITALITY

Term	Definition
Disturbance	Damage caused by any factor (biotic or abiotic) that adversely affects the vigour and productivity of the forest and which is not a direct result of human activities.

Invasive species	Species that are non-native to a particular ecosystem and whose introduction and spread cause, or are likely to cause, socio-cultural, economic or environmental harm or harm to human health.

Category	Definition
Disturbance by insects	Disturbance caused by insect pests.
Disturbance by diseases	Disturbance caused by diseases attributable to pathogens, such as bacteria, fungi, phytoplasma or virus.
Disturbance by other biotic agents	Disturbance caused by biotic agents other than insects or diseases, such as wildlife browsing, grazing, physical damage by animals, etc.
Disturbance caused by abiotic factors	Disturbances caused by abiotic factors, such as air pollution, snow, storm, drought, etc.

WOOD REMOVALS

Category	Definition
Industrial roundwood removals	The wood removed (volume of roundwood over bark) for production of goods and services other than energy production (woodfuel).
Woodfuel removals	The wood removed for energy production purposes, regardless whether for industrial, commercial or domestic use.

NON WOOD FOREST PRODUCTS AND VALUE

Term	Definition
Non-wood forest product (NWFP)	Goods derived from forests that are tangible and physical objects of biological origin other than wood.
Value of NWFP removals	For the purpose of this table, value is defined as the market value at the site of collection or forest border.

EMPLOYMENT

Category	Definition
Full-time equivalents (FTE)	A measurement equal to one person working full-time during a specified reference period.
Employment	Includes all persons in paid employment or self-employment.
Paid employment	Persons who during a specified reference period performed some work for wage or salary in cash or in kind.
Self-employment	Persons who during a specified reference period performed some work for profit or family gain in cash or in kind (e.g. employers, own-account workers, members of producers' cooperatives, contributing family workers).

Category	Definition
Employment in primary production of goods[37]	Employment in activities related to production of goods derived from forests.
Employment in management of protected areas	Employment in activities related to the management of protected areas with forests.

POLICY AND LEGAL FRAMEWORK

Term	Definition
Forest policy	A set of orientations and principles of actions adopted by public authorities in harmony with national socio-economic and environmental policies in a given country to guide future decisions in relation to the management, use and conservation of forest and tree resources for the benefit of society.
Forest policy statement	A document that describes the objectives, priorities and means for implementation of the forest policy.
National forest programme (NFP)	A generic expression that refers to a wide range of approaches towards forest policy formulation, planning and implementation at national and sub-national levels. The national forest programme provides a framework and guidance for country-driven forest sector development with participation of all stakeholders and in consistence with policies of other sectors and international policies.
Law (Act or Code) on forest	A set of rules enacted by the legislative authority of a country regulating the access, management, conservation and use of forest resources.

INSTITUTIONAL FRAMEWORK

Term	Definition
Minister responsible for forest policy-making	Minister holding the main responsibility for forest issues and the formulation of the forest policy.
Head of Forestry	The Head of Forestry is the government officer responsible for implementing the mandate of the public administration related to forests.
Level of subordination	Number of administrative levels between the Head of Forestry and the Minister.
University degree	Qualification provided by a university after a minimum of 3 years of post secondary education.

[37] This category corresponds to the ISIC/NACE Rev. 4 activity A02 (Forestry, logging and related service activities) with the exception of the activities "growing of Christmas trees" and "growing of rubber trees" which are included in the FRA definition but excluded in the ISIC activity A02.

EDUCATION AND RESEARCH

Term	Definition
Forest-related education	Post-secondary education programme with focus on forests and related subjects.
Doctor's degree (Ph.D.)	University (or equivalent) education with a total duration of about 8 years.
Master's degree (M.Sc.) or equivalent	University (or equivalent) education with a total duration of about 5 years.
Bachelor's degree (B.Sc.) or equivalent	University (or equivalent) education with a duration of about 3 years.
Technician certificate or diploma	Qualification issued from a technical education institution consisting of 1 to 3 years post secondary education.
Publicly funded forest research centres	Research centres primarily implementing research programmes on forest matters. Funding is mainly public or channelled through public institutions.

PUBLIC REVENUE AND COLLECTION OF EXPENDITURE

Category	Definition
Forest revenue	All government revenue collected from the domestic production and trade of forest products and services. For this purpose, forest products include: roundwood; sawnwood; wood-based panels; pulp and paper; and non-wood forest products. As far as possible, this should include revenue collected by all levels of government (i.e. central, regional/provincial and municipal level), but it should exclude the income of publicly owned business entities.
Public expenditure	All government expenditure on forest related activities (further defined below).
Operational expenditure *(sub-category of Public expenditure)*	All government expenditure on public institutions solely engaged in the forest sector. Where the forest administration is part of a larger public agency (e.g. department or ministry), this should only include the forest sector component of the agency's total expenditure. As far as possible, this should also include other institutions (e.g. in research, training and marketing) solely engaged in the forest sector, but it should exclude the expenditure of publicly owned business entities.
Transfer payments *(sub-category of Public expenditure)*	All government expenditure on direct financial incentives paid to non-government and private-sector institutions, enterprises communities or individuals operating in the forest sector to implement forest related activities.
Domestic funding	Public expenditure funded from domestic public financial resources, including: retained forest revenue; forest-related funds; and allocations from the national budget (i.e. from non-forest sector public revenue sources).
External funding	Public expenditure funded from grants and loans from donors, non-governmental organisations, international lending agencies and international organisations, where such funds are channelled through national public institutions.

Annex 3
Global tables

NOTES

Country nomenclature and regional groups used in the tables

The names of countries and areas used in these tables follow standard UN practice regarding nomenclature. The regional groups used in these tables represent FAO's standardized regional breakdown of the world according to geographical criteria.

Data source

Unless otherwise stated, the information provided in these tables is derived from officially validated country reports. These reports contain detailed information on data sources, original data and an explanation of how the reported figures were calculated, as well as explanatory notes for each of the tables. All the reports are available on the FAO web site www.fao.org/forestry/fra2010) in English, French or Spanish.

Definitions

Annex 2 contains the terms and definitions for all variables listed in the tables.

Totals

Numbers may not tally because of rounding. Global and regional totals are omitted in those cases where the sum of the reported values would not give a correct estimate because of incomplete data sets.

Abbreviations

n.s. = not significant, indicating a very small value
– = data not available
FTE = full-time equivalent
NWFP = non wood forest product

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TABLE 1
Basic data on countries and areas

Country/area	Land area[a] (1 000 ha)	Population 2008[b]				GDP 2008[c]	
		Total (1 000)	Density (Population/ km²)	Annual growth rate (%)	Rural (% of total)	Per capita (PPP) (US$)	Annual growth rate (%)
Angola	124 670	18 021	14	2.7	43	5 820	13.2
Botswana	56 673	1 921	3	1.5	40	13 574	2.9
Comoros	186	850	457	2.4	72	1 170	1.0
Djibouti	2 318	849	37	1.8	13	2 138	3.9
Eritrea	10 100	4 927	49	3.1	79	642	2.0
Ethiopia**	109 631	80 713	74	2.6	83	869	11.3
Kenya	56 914	38 765	68	2.7	78	1 551	1.7
Lesotho	3 035	2 049	68	0.8	75	1 564	3.9
Madagascar	58 154	19 111	33	2.7	71	1 054	7.3
Malawi	9 408	14 846	158	2.8	81	805	9.7
Mauritius	203	1 280	631	0.7	58	12 356	4.5
Mayotte	37	189	505	2.7	–	4 900	–
Mozambique	78 638	22 383	28	2.4	63	838	6.8
Namibia	82 329	2 130	3	2.0	63	6 398	2.9
Réunion	250	817	327	1.4	7	–	–
Seychelles	46	84	183	1.2	45	21 392	2.8
Somalia	62 734	8 926	14	2.2	64	600	2.6
South Africa	121 447	49 668	41	1.0	39	10 116	3.1
Swaziland	1 720	1 168	68	1.5	75	4 927	2.4
Uganda	19 710	31 657	161	3.3	87	1 166	9.5
United Republic of Tanzania	88 580	42 484	48	2.9	75	1 301	7.5
Zambia	74 339	12 620	17	2.5	65	1 357	6.0
Zimbabwe	38 685	12 463	32	0.1	63	200	-14.1
Eastern and Southern Africa	**999 807**	**367 921**	**37**	**2.4**	**69**	**2 660**	**4.8**
Algeria	238 174	34 373	14	1.5	35	8 036	3.0
Egypt	99 545	81 527	82	1.8	57	5 425	7.2
Libyan Arab Jamahiriya	175 954	6 294	4	2.0	23	16 208	3.8
Mauritania	103 070	3 215	3	2.4	59	2 100	2.2
Morocco	44 630	31 606	71	1.2	44	4 263	5.6
Sudan	237 600	41 348	17	2.3	57	2 155	8.3
Tunisia	15 536	10 169	65	1.0	34	7 956	4.5
Western Sahara	26 600	497	2	3.5	19	2 500	–
Northern Africa	**941 109**	**209 029**	**22**	**1.7**	**49**	**5 422**	**5.5**
Benin	11 062	8 662	78	3.2	59	1 473	5.1
Burkina Faso	27 360	15 234	56	3.5	81	1 160	4.5
Burundi	2 568	8 074	314	3.0	90	383	4.5
Cameroon	47 271	19 088	40	2.3	43	2 195	3.9
Cape Verde	403	499	124	1.4	40	3 202	2.8
Central African Republic	62 300	4 339	7	1.9	62	741	2.2
Chad	125 920	10 914	9	2.7	73	1 337	-0.2
Congo	34 150	3 615	11	1.8	39	3 949	5.6
Côte d'Ivoire	31 800	20 591	65	2.3	51	1 652	2.2
Democratic Republic of the Congo	226 705	64 257	28	2.8	66	314	6.2
Equatorial Guinea	2 805	659	23	2.6	61	33 899	11.3
Gabon	25 767	1 448	6	1.8	15	14 575	2.3
Gambia	1 000	1 660	166	2.7	44	1 363	5.9
Ghana	22 754	23 351	103	2.1	50	1 463	7.3

TABLE 1 (continued)
Basic data on countries and areas

Country/area	Land area[a] (1 000 ha)	Population 2008[b]				GDP 2008[c]	
		Total (1 000)	Density (Population/ km²)	Annual growth rate (%)	Rural (% of total)	Per capita (PPP) (US$)	Annual growth rate (%)
Guinea	24 572	9 833	40	2.3	66	1 056	4.7
Guinea-Bissau	2 812	1 575	56	2.2	70	537	3.3
Liberia	9 632	3 793	39	4.6	40	388	7.1
Mali	122 019	12 706	10	2.4	68	1 129	5.0
Niger	126 670	14 704	12	4.0	84	683	9.5
Nigeria	91 077	151 212	166	2.4	52	2 099	6.0
Rwanda	2 467	9 721	394	2.8	82	1 027	11.2
Saint Helena, Ascension and Tristan da Cunha**	31	5	16	n.s.	60	2 500	–
Sao Tome and Principe	96	160	167	1.3	39	1 748	5.8
Senegal	19 253	12 211	63	2.7	58	1 793	3.3
Sierra Leone	7 162	5 560	78	2.6	62	782	5.5
Togo	5 439	6 459	119	2.5	58	830	1.1
Western and Central Africa	**1 033 095**	**410 330**	**40**	**2.6**	**59**	**1 559**	**5.4**
Africa	**2 974 011**	**987 280**	**33**	**2.3**	**61**	**2 787**	**5.2**
China**	942 530	1 344 919	143	0.6	57	5 971	9.0
Democratic People's Republic of Korea	12 041	23 819	198	0.4	37	1 800	3.7
Japan	36 450	127 293	349	-0.1	34	34 129	-0.7
Mongolia	156 650	2 641	2	1.1	43	3 557	8.9
Republic of Korea	9 873	48 152	488	0.4	19	27 658	2.2
East Asia	**1 157 544**	**1 546 824**	**134**	**0.5**	**53**	**8 895**	**2.3**
Bangladesh	13 017	160 000	1 229	1.4	73	1 335	6.2
Bhutan	4 700	687	15	1.6	66	4 759	13.8
Brunei Darussalam	527	392	74	1.8	25	51 300	-1.5
Cambodia	17 652	14 562	82	1.7	79	1 951	6.7
India	297 319	1 181 412	397	1.4	71	2 946	6.1
Indonesia	181 157	227 345	125	1.2	49	3 994	6.1
Lao People's Democratic Republic	23 080	6 205	27	1.9	69	2 124	7.5
Malaysia	32 855	27 014	82	1.7	30	14 215	4.6
Maldives	30	305	1 017	1.3	62	5 597	5.2
Myanmar	65 755	49 563	75	0.9	67	1 200	4.0
Nepal	14 300	28 810	201	1.8	83	1 104	5.3
Pakistan	77 088	176 952	230	2.2	64	2 538	2.0
Philippines	29 817	90 348	303	1.8	35	3 513	3.8
Singapore	69	4615	6 698	2.9	0	49 321	1.1
Sri Lanka	6 463	20 061	310	0.9	85	4 564	6.0
Thailand	51 089	67 386	132	0.6	67	8 086	2.5
Timor-Leste	1 487	1 098	74	3.2	73	802	13.2
Viet Nam	31 008	87 096	281	1.1	72	2 787	6.2
South and Southeast Asia	**847 413**	**2 143 851**	**253**	**1.4**	**66**	**3 274**	**4.9**
Afghanistan	65 209	27 208	42	3.5	76	1 103	2.3
Armenia	2 820	3 077	109	0.2	36	6 075	6.8
Azerbaijan	8 263	8 731	106	1.1	48	8 771	10.8
Bahrain	71	776	1 093	2.1	12	34 899	6.3
Cyprus	924	862	93	0.9	30	26 919	3.6
Georgia	6 949	4 307	62	-1.2	47	4 966	2.0
Iran (Islamic Republic of)	162 855	73 312	45	1.2	32	11 666	5.6

TABLE 1 (continued)
Basic data on countries and areas

Country/area	Land area[a] (1 000 ha)	Population 2008[b]				GDP 2008[c]	
		Total (1 000)	Density (Population/ km²)	Annual growth rate (%)	Rural (% of total)	Per capita (PPP) (US$)	Annual growth rate (%)
Iraq	43 737	30 096	69	2.1	34	3 200	9.5
Israel	2 164	7 051	326	1.7	8	27 905	4.0
Jordan	8 824	6 136	70	3.3	22	5 474	7.9
Kazakhstan	269 970	15 521	6	0.7	42	11 323	3.2
Kuwait	1 782	2 919	164	2.4	2	57 500	6.3
Kyrgyzstan	19 180	5 414	28	1.3	64	2 193	7.6
Lebanon	1 023	4 194	410	0.8	13	11 777	8.5
Occupied Palestinian Territory	602	4 147	689	3.2	28	2 900	2.0
Oman	30 950	2 785	9	2.2	28	20 200	7.8
Qatar	1 100	1 281	116	12.6	4	111 000	16.4
Saudi Arabia**	200 000	25 201	13	2.1	18	23 991	4.4
Syrian Arab Republic	18 378	21 227	116	3.5	46	4 583	5.2
Tajikistan	13 996	6 836	49	1.6	74	1 907	7.9
Turkey	76 963	73 914	96	1.2	31	13 417	0.9
Turkmenistan	46 993	5 044	11	1.3	51	6 625	9.8
United Arab Emirates	8 360	4 485	54	2.8	22	44 600	7.4
Uzbekistan	42 540	27 191	64	1.1	63	2 658	9.0
Yemen	52 797	22 917	43	2.9	69	2 416	3.9
Western and Central Asia	**1 086 450**	**384 632**	**35**	**1.8**	**40**	**10 560**	**3.4**
Asia	**3 091 407**	**4 075 307**	**132**	**1.1**	**59**	**6 095**	**2.9**
Albania	2 740	3 143	115	0.4	53	7 293	6.0
Andorra	45	84	187	1.2	11	42 500	3.6
Austria	8 245	8 337	101	0.4	33	37 912	1.8
Belarus	20 748	9 679	47	-0.5	27	12 278	10.0
Belgium	3 028	10 590	350	0.6	3	35 238	1.1
Bosnia and Herzegovina	5 120	3 773	74	-0.1	53	8 095	5.4
Bulgaria	10 864	7 593	70	-0.6	29	11 792	6.0
Croatia	5 592	4 423	79	-0.1	43	17 663	2.4
Czech Republic	7 726	10 319	134	0.5	27	24 643	2.5
Denmark	4 243	5 458	129	0.2	13	36 845	-1.1
Estonia	4 239	1 341	32	-0.1	31	20 651	-3.6
Faroe Islands	140	50	36	2.0	58	31 000	–
Finland	30 409	5 304	17	0.4	37	36 195	0.9
France	55 010	62 036	113	0.5	23	33 058	0.4
Germany	34 877	82 264	236	-0.1	26	35 374	1.3
Gibraltar	1	31	3 100	n.s.	0	38 200	–
Greece	12 890	11 137	86	0.2	39	29 356	2.9
Guernsey	8	66	846	0.2	69	44 600	–
Holy See*	n.s.	1	1 877	n.s.	0	–	–
Hungary	8 961	10 012	112	-0.2	33	19 789	0.6
Iceland	10 025	315	3	2.3	8	36 902	0.3
Ireland	6 888	4 437	64	1.9	39	41 850	-3.0
Isle of Man	57	80	140	n.s.	49	35 000	–
Italy	29 411	59 604	203	0.5	32	31 283	-1.0
Jersey*	12	92	767	0.2	69	57 000	–
Latvia	6 229	2 259	36	-0.4	32	16 357	-4.6
Liechtenstein	16	36	225	2.9	86	118 000	1.8

TABLE 1 (continued)
Basic data on countries and areas

Country/area	Land area[a] (1 000 ha)	Population 2008[b]				GDP 2008[c]	
		Total (1 000)	Density (Population/ km²)	Annual growth rate (%)	Rural (% of total)	Per capita (PPP) (US$)	Annual growth rate (%)
Lithuania	6 268	3 321	53	-1.0	33	17 753	3.0
Luxembourg	259	481	186	1.3	18	78 922	-0.9
Malta	32	407	1 272	0.2	6	24 600	2.1
Monaco*	n.s.	33	16 483	n.s.	0	30 000	10.0
Montenegro	1 345	622	46	0.2	40	13 385	8.1
Netherlands	3 388	16 528	488	0.4	18	40 961	2.1
Norway	30 427	4 767	16	1.0	23	58 714	2.1
Poland	30 633	38 104	124	-0.1	39	17 275	4.9
Portugal**	9 068	10 677	118	0.3	41	23 254	0.0
Republic of Moldova	3 287	3 633	111	-0.9	58	2 979	7.2
Romania	22 998	21 361	93	-0.4	46	13 449	9.4
Russian Federation	1 638 139	141 394	9	-0.4	27	15 923	5.6
San Marino	6	31	517	n.s.	7	41 900	1.9
Serbia**	8 746	9 839	112	0.1	48	10 554	1.2
Slovakia	4 810	5 400	112	0.1	44	22 138	6.2
Slovenia	2 014	2 015	100	0.2	52	27 866	3.5
Spain	49 919	44 486	89	1.0	23	31 674	1.2
Svalbard and Jan Mayen Islands*	6 100	2	n.s.	n.s.	–	–	–
Sweden	41 033	9 205	22	0.5	16	36 961	-0.2
Switzerland	4 000	7 541	189	0.4	27	42 415	1.8
The former Yugoslav Republic of Macedonia	2 543	2 041	80	n.s.	33	9 337	5.0
Ukraine	57 938	45 992	79	-0.6	32	7 277	2.1
United Kingdom**	24 250	61 461	253	0.5	10	35 468	0.7
Europe	**2 214 726**	**731 805**	**33**	**0.1**	**28**	**25 585**	**1.1**
Anguilla	9	15	165	7.1	0	8 800	15.3
Antigua and Barbuda	44	87	198	1.2	69	20 970	2.5
Aruba	18	105	583	1.0	53	21 800	-1.6
Bahamas	1 001	338	34	1.2	16	30 700	1.0
Barbados	43	255	593	n.s.	60	18 900	0.2
Bermuda	5	65	1 300	n.s.	0	69 900	4.4
British Virgin Islands	15	23	153	n.s.	61	38 500	2.5
Cayman Islands	26	56	215	1.8	0	43 800	3.2
Cuba	10 982	11 205	102	n.s.	24	9 500	4.3
Dominica	75	67	89	n.s.	25	8 706	4.3
Dominican Republic**	4 839	9 953	206	1.4	31	8 125	5.3
Grenada	34	104	306	1.0	69	8 882	2.1
Guadeloupe**	161	464	288	0.4	2	–	–
Haiti	2 756	9 876	358	1.6	53	1 124	1.3
Jamaica	1 083	2 708	250	0.4	47	7 716	-1.3
Martinique	106	403	380	0.2	2	–	–
Montserrat	10	6	58	n.s.	83	3 400	11.8
Netherlands Antilles	80	195	244	1.6	7	16 000	2.2
Puerto Rico	887	3 965	447	0.4	2	17 800	0.2
Saint Kitts and Nevis	26	51	196	2.0	69	16 467	8.2
Saint Lucia	61	170	279	0.6	72	9 836	0.5
Saint Martin (French part)*	5	30	548	–	–	–	–
Saint Vincent and the Grenadines	39	109	279	n.s.	53	8 998	-1.1

TABLE 1 (continued)
Basic data on countries and areas

Country/area	Land area[a] (1 000 ha)	Population 2008[b]				GDP 2008[c]	
		Total (1 000)	Density (Population/ km²)	Annual growth rate (%)	Rural (% of total)	Per capita (PPP) (US$)	Annual growth rate (%)
Saint Barthélemy*	2	7	355	–	–	–	–
Trinidad and Tobago	513	1 333	260	0.4	87	25 173	3.5
Turks and Caicos Islands	43	33	77	3.1	9	11 500	12.9
United States Virgin Islands	35	110	318	n.s.	6	14 500	–
Caribbean	**22 898**	**41 733**	**182**	**0.8**	**34**	**8 647**	**3.3**
Belize	2 281	301	13	2.0	48	6 743	3.8
Costa Rica	5 106	4 519	89	1.3	37	11 232	2.6
El Salvador	2 072	6 134	296	0.4	39	6 799	2.5
Guatemala	10 843	13 686	126	2.5	52	4 760	4.0
Honduras	11 189	7 319	65	2.0	52	3 932	4.0
Nicaragua	12 140	5 667	47	1.3	43	2 689	3.5
Panama	7 443	3 399	46	1.7	27	12 498	9.2
Central America	**51 074**	**41 025**	**80**	**1.7**	**45**	**6 000**	**4.3**
Canada	909 351	33 259	4	1.0	20	39 078	0.4
Greenland	41 045	57	n.s.	n.s.	16	20 000	0.3
Mexico	194 395	108 555	56	1.0	23	14 570	1.8
Saint Pierre and Miquelon	23	6	26	n.s.	17	7 000	–
United States of America	916 193	311 666	34	1.0	18	46 350	0.4
North America	**2 061 007**	**453 543**	**22**	**1.0**	**19**	**38 206**	**0.5**
North and Central America	**2 134 979**	**536 301**	**25**	**1.0**	**23**	**33 443**	**0.5**
American Samoa	20	66	330	1.5	8	8 000	–
Australia**	768 228	21 074	3	1.1	11	38 784	3.7
Cook Islands	24	20	83	n.s.	25	9 100	2.9
Fiji	1 827	844	46	0.6	48	4 358	0.2
French Polynesia	366	266	73	1.5	49	18 000	2.6
Guam	55	176	320	1.7	7	–	–
Kiribati	81	97	120	2.1	56	2 426	3.0
Marshall Islands	18	61	339	3.4	30	2 500	1.5
Micronesia (Federated States of)	70	110	157	n.s.	78	3 091	-2.9
Nauru	2	10	500	n.s.	0	5 000	-12.1
New Caledonia	1 828	246	13	1.2	35	15 000	0.6
New Zealand	26 771	4 230	16	0.9	14	27 260	-1.1
Niue	26	2	8	n.s.	50	5 800	–
Norfolk Island	4	2	59	n.s.	–	–	–
Northern Mariana Islands	46	85	185	1.2	9	12 500	–
Palau	46	20	43	n.s.	20	8 100	-1.0
Papua New Guinea	45 286	6 577	15	2.4	88	2 180	6.6
Pitcairn	4	n.s.	1	n.s.	100	–	–
Samoa	283	179	63	n.s.	77	4 555	-3.4
Solomon Islands	2 799	511	18	2.6	82	2 613	6.9
Tokelau	1	1	100	n.s.	100	1 000	–
Tonga	72	104	144	1.0	75	3 837	0.8
Tuvalu	3	10	333	n.s.	50	1 600	2.0
Vanuatu	1 220	234	19	2.6	75	3 935	6.6
Wallis and Futuna Islands	14	15	107	n.s.	100	3 800	–
Oceania	**849 094**	**34 940**	**4**	**1.3**	**30**	**27 630**	**3.2**

TABLE 1 (continued)
Basic data on countries and areas

Country/area	Land area[a] (1 000 ha)	Population 2008[b]				GDP 2008[c]	
		Total (1 000)	Density (Population/ km²)	Annual growth rate (%)	Rural (% of total)	Per capita (PPP) (US$)	Annual growth rate (%)
Argentina	273 669	39 883	15	1.0	8	14 303	6.8
Bolivia (Plurinational State of)	108 438	9 694	9	1.8	34	4 277	6.1
Brazil**	832 512	191 972	23	1.0	14	10 304	5.1
Chile	74 880	16 804	22	1.0	12	14 436	3.2
Colombia	110 950	45 012	41	1.5	26	8 797	2.5
Ecuador	27 684	13 481	49	1.0	34	8 014	6.5
Falkland Islands (Malvinas)[d]	1 217	3	n.s.	n.s.	0	35 400	–
French Guiana**	8 220	220	3	2.8	24	–	–
Guyana	19 685	763	4	-0.1	72	3 064	3.0
Paraguay	39 730	6 238	16	1.8	40	4 704	5.8
Peru	128 000	28 837	23	1.2	29	8 509	9.8
Suriname	15 600	515	3	1.0	25	7 401	5.1
Uruguay	17 502	3 349	19	0.3	8	12 744	8.9
Venezuela (Bolivarian Republic of)	88 205	28 121	32	1.7	7	12 818	4.8
South America	**1 746 292**	**384 892**	**22**	**1.2**	**17**	**10 446**	**5.4**
World[e]	**13 010 509**	**6 750 525**	**52**	**1.2**	**50**	**10 394**	**1.7**

[a] Total area of the country excluding inland water bodies. The figures are from FAOSTAT (FAO, 2008) unless otherwise indicated.
* = Source CIA (2010). ** = Country estimate.

[b] *General Source:* FAOSTAT-PopSTAT (http://faostat.fao.org/site/550/default.aspx#ancor).
Source for Mayotte, Holy See and Isle of Man: UNPD (2010).
Source for Guernsey, Svalbard and Jan Mayen Islands, Saint Martin (French part), Pitcairn: CIA (2010).

[c] Per capita gross domestic product (GDP) is expressed at purchasing power parity (PPP).
General source: World Bank (2010).
Complementary sources: IMF (2010); UNSD (2010); CIA (2010).

[d] A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

[e] World totals correspond to the sum of the reporting units. About 35 million hectares of land in Antarctica, some Arctic and Antarctic islands and some other small islands are not included.

TABLE 2
Extent of forest and other wooded land 2010

Country/area	Land area						Inland water (1 000 ha)	Country area (1 000 ha)
	Forest		Other wooded land		Other land (1 000 ha)			
	1 000 ha	% of land area	1 000 ha	% of land area	Total	of which with tree cover		
Angola	58 480	47	0	0	66 190	–	0	124 670
Botswana	11 351	20	34 791	61	10 531	–	1 500	58 173
Comoros	3	2	0	0	183	–	0	186
Djibouti	6	n.s.	220	9	2 092	–	2	2 320
Eritrea	1 532	15	7 153	71	1 415	–	1 660	11 760
Ethiopia	12 296	11	44 650	41	52 685	–	799	110 430
Kenya	3 467	6	28 650	50	24 797	10 385	1 123	58 037
Lesotho	44	1	97	3	2 894	–	0	3 035
Madagascar	12 553	22	15 688	27	29 913	–	550	58 704
Malawi	3 237	34	0	0	6 171	–	2 440	11 848
Mauritius	35	17	12	6	156	–	1	204
Mayotte	14	37	n.s.	1	23	–	0	37
Mozambique	39 022	50	14 566	19	25 050	–	1 300	79 938
Namibia	7 290	9	8 290	10	66 749	–	100	82 429
Réunion	88	35	51	20	111	–	1	251
Seychelles	41	88	0	0	5	–	0	46
Somalia	6 747	11	0	0	55 987	–	1 032	63 766
South Africa	9 241	8	24 558	20	87 648	30	462	121 909
Swaziland	563	33	427	25	730	–	16	1 736
Uganda	2 988	15	3 383	17	13 339	–	4 394	24 104
United Republic of Tanzania	33 428	38	11 619	13	43 533	–	6 150	94 730
Zambia	49 468	67	6 075	8	18 796	–	922	75 261
Zimbabwe	15 624	40	0	0	23 061	–	391	39 076
Eastern and Southern Africa	**267 517**	**27**	**200 231**	**20**	**532 059**	**10 415**	**22 843**	**1 022 650**
Algeria	1 492	1	2 685	1	233 997	–	0	238 174
Egypt	70	n.s.	20	n.s.	99 455	36	600	100 145
Libyan Arab Jamahiriya	217	n.s.	330	n.s.	175 407	–	0	175 954
Mauritania	242	n.s.	3 060	3	99 768	–	0	103 070
Morocco	5 131	11	631	1	38 868	1 600	25	44 655
Sudan	69 949	29	50 224	21	117 427	–	12 981	250 581
Tunisia	1 006	6	300	2	14 230	2 204	825	16 361
Western Sahara	707	3	0	0	25 893	–	0	26 600
Northern Africa	**78 814**	**8**	**57 250**	**6**	**805 045**	**3 840**	**14 431**	**955 540**
Benin	4 561	41	2 889	26	3 612	289	200	11 262
Burkina Faso	5 649	21	5 009	18	16 702	5 902	40	27 400
Burundi	172	7	722	28	1 674	–	215	2 783
Cameroon	19 916	42	12 715	27	14 640	–	273	47 544
Cape Verde	85	21	0	0	318	–	0	403
Central African Republic	22 605	36	10 122	16	29 573	–	0	62 300
Chad	11 525	9	8 847	7	105 548	–	2 480	128 400
Congo	22 411	66	10 513	31	1 226	–	50	34 200
Côte d'Ivoire	10 403	33	2 590	8	18 807	436	446	32 246
Democratic Republic of the Congo	154 135	68	11 513	5	61 057	–	7 781	234 486
Equatorial Guinea	1 626	58	8	n.s.	1 171	–	0	2 805
Gabon	22 000	85	0	0	3 767	–	1 000	26 767
Gambia	480	48	103	10	417	–	130	1 130
Ghana	4 940	22	0	0	17 814	–	1 100	23 854
Guinea	6 544	27	5 850	24	12 178	–	14	24 586
Guinea-Bissau	2 022	72	230	8	560	–	800	3 612
Liberia	4 329	45	0	0	5 303	–	1 505	11 137

TABLE 2 (continued)
Extent of forest and other wooded land 2010

Country/area	Land area						Inland water (1 000 ha)	Country area (1 000 ha)
	Forest		Other wooded land		Other land (1 000 ha)			
	1 000 ha	% of land area	1 000 ha	% of land area	Total	of which with tree cover		
Mali	12 490	10	8 227	7	101 302	–	2 000	124 019
Niger	1 204	1	3 440	3	122 026	8 000	30	126 700
Nigeria	9 041	10	4 088	4	77 948	245	1 300	92 377
Rwanda	435	18	61	2	1 971	–	167	2 634
Saint Helena, Ascension and Tristan da Cunha	2	6	0	0	29	–	0	31
Sao Tome and Principe	27	28	29	30	40	10	0	96
Senegal	8 473	44	4 911	26	5 869	1 174	419	19 672
Sierra Leone	2 726	38	189	3	4 247	9	12	7 174
Togo	287	5	1 246	23	3 906	–	240	5 679
Western and Central Africa	**328 088**	**32**	**93 302**	**9**	**611 705**	**16 065**	**20 202**	**1 053 297**
Africa	**674 419**	**23**	**350 783**	**12**	**1 948 809**	**30 320**	**57 476**	**3 031 487**
China	206 861	22	102 012	11	633 658	–	17 470	960 000
Democratic People's Republic of Korea	5 666	47	0	0	6 375	–	13	12 054
Japan	24 979	69	0	0	11 471	–	1 341	37 791
Mongolia	10 898	7	1 947	1	143 805	0	0	156 650
Republic of Korea	6 222	63	0	0	3 651	–	53	9 926
East Asia	**254 626**	**22**	**103 959**	**9**	**798 960**	**0**	**18 877**	**1 176 421**
Bangladesh	1 442	11	289	2	11 286	2 209	1 383	14 400
Bhutan	3 249	69	613	13	838	–	0	4 700
Brunei Darussalam	380	72	50	9	97	–	50	577
Cambodia	10 094	57	133	1	7 425	–	452	18 104
India	68 434	23	3 267	1	225 618	1 528	31 407	328 726
Indonesia	94 432	52	21 003	12	65 722	–	9 300	190 457
Lao People's Democratic Republic	15 751	68	4 834	21	2 495	–	600	23 680
Malaysia	20 456	62	0	0	12 399	–	119	32 974
Maldives	1	3	0	0	29	–	0	30
Myanmar	31 773	48	20 113	31	13 869	–	1 903	67 658
Nepal	3 636	25	1 897	13	8 767	–	418	14 718
Pakistan	1 687	2	1 455	2	73 946	–	2 522	79 610
Philippines	7 665	26	10 128	34	12 024	–	183	30 000
Singapore	2	3	0	0	67	0	1	70
Sri Lanka	1 860	29	0	0	4 603	–	98	6 561
Thailand	18 972	37	0	0	32 117	–	223	51 312
Timor-Leste	742	50	0	0	745	–	0	1 487
Viet Nam	13 797	44	1 124	4	16 087	–	1 924	32 932
South and Southeast Asia	**294 373**	**35**	**64 906**	**8**	**488 134**	**3 737**	**50 583**	**897 996**
Afghanistan	1 350	2	29 471	45	34 388	–	0	65 209
Armenia	262	9	45	2	2 513	–	160	2 980
Azerbaijan	936	11	54	1	7 273	–	397	8 660
Bahrain	1	1	n.s.	n.s.	70	–	0	71
Cyprus	173	19	214	23	537	26	1	925
Georgia	2 742	39	51	1	4 156	–	21	6 970
Iran (Islamic Republic of)	11 075	7	5 340	3	146 440	83	11 660	174 515
Iraq	825	2	259	1	42 653	70	95	43 832
Israel	154	7	33	2	1 977	1	43	2 207
Jordan	98	1	51	1	8 676	222	54	8 878
Kazakhstan	3 309	1	16 479	6	250 182	3	2 520	272 490
Kuwait	6	n.s.	0	0	1 776	–	0	1 782
Kyrgyzstan	954	5	390	2	17 836	–	810	19 990

TABLE 2 (continued)
Extent of forest and other wooded land 2010

Country/area	Land area						Inland water (1 000 ha)	Country area (1 000 ha)
	Forest		Other wooded land		Other land (1 000 ha)			
	1 000 ha	% of land area	1 000 ha	% of land area	Total	of which with tree cover		
Lebanon	137	13	106	10	780	114	17	1 040
Occupied Palestinian Territory	9	2	0	0	593	–	19	621
Oman	2	n.s.	1 303	4	29 645	50	0	30 950
Qatar	0	0	1	n.s.	1 100	–	0	1 100
Saudi Arabia	977	n.s.	1 117	1	197 906	705	0	200 000
Syrian Arab Republic	491	3	35	n.s.	17 852	231	140	18 518
Tajikistan	410	3	142	1	13 444	102	259	14 255
Turkey	11 334	15	10 368	13	55 261	2 553	1 393	78 356
Turkmenistan	4 127	9	0	0	42 866	–	1 817	48 810
United Arab Emirates	317	4	4	n.s.	8 038	188	0	8 360
Uzbekistan	3 276	8	874	2	38 391	344	2 200	44 740
Yemen	549	1	1 406	3	50 842	500	0	52 797
Western and Central Asia	**43 513**	**4**	**67 743**	**6**	**975 194**	**5 191**	**21 606**	**1 108 056**
Asia	**592 512**	**19**	**236 607**	**8**	**2 262 287**	**8 928**	**91 066**	**3 182 473**
Albania	776	28	255	9	1 709	–	135	2 875
Andorra	16	36	0	0	29	–	0	45
Austria	3 887	47	119	1	4 239	–	142	8 387
Belarus	8 630	42	520	3	11 598	–	12	20 760
Belgium	678	22	28	1	2 322	–	25	3 053
Bosnia and Herzegovina	2 185	43	549	11	2 386	–	1	5 121
Bulgaria	3 927	36	0	0	6 937	45	236	11 100
Croatia	1 920	34	554	10	3 118	205	62	5 654
Czech Republic	2 657	34	0	0	5 069	92	161	7 887
Denmark	544	13	47	1	3 652	6	67	4 310
Estonia	2 217	52	133	3	1 889	–	284	4 523
Faroe Islands	n.s.	n.s.	0	0	140	–	0	140
Finland	22 157	73	1 112	4	7 140	183	3 433	33 842
France	15 954	29	1 618	3	37 438	263	140	55 150
Germany	11 076	32	0	0	23 801	1 400	828	35 705
Gibraltar	0	0	0	0	1	0	0	1
Greece	3 903	30	2 636	20	6 351	–	306	13 196
Guernsey	n.s.	3	0	0	8	0	0	8
Holy See	0	0	0	0	n.s.	0	0	n.s.
Hungary	2 029	23	0	0	6 932	103	342	9 303
Iceland	30	n.s.	86	1	9 909	10	275	10 300
Ireland	739	11	50	1	6 099	–	138	7 026
Isle of Man	3	6	0	0	54	0	n.s.	57
Italy	9 149	31	1 767	6	18 495	–	723	30 134
Jersey	1	5	0	0	11	0	n.s.	12
Latvia	3 354	54	113	2	2 762	29	230	6 459
Liechtenstein	7	43	1	3	9	–	0	16
Lithuania	2 160	34	80	1	4 028	63	262	6 530
Luxembourg	87	33	1	1	171	–	0	259
Malta	n.s.	1	0	0	32	–	0	32
Monaco	0	0	0	0	n.s.	n.s.	0	n.s.
Montenegro	543	40	175	13	627	–	36	1 381
Netherlands	365	11	0	0	3 023	0	765	4 153
Norway	10 065	33	2 703	9	17 659	–	1 953	32 380
Poland	9 337	30	0	0	21 296	–	636	31 269
Portugal	3 456	38	155	2	5 457	–	144	9 212
Republic of Moldova	386	12	70	2	2 831	–	97	3 384

TABLE 2 (continued)
Extent of forest and other wooded land 2010

Country/area	Land area						Inland water (1 000 ha)	Country area (1 000 ha)
	Forest		Other wooded land		Other land (1 000 ha)			
	1 000 ha	% of land area	1 000 ha	% of land area	Total	of which with tree cover		
Romania	6 573	29	160	1	16 265	–	841	23 839
Russian Federation	809 090	49	73 220	4	755 829	5 650	71 685	1 709 824
San Marino	0	0	0	0	6	–	0	6
Serbia	2 713	31	410	5	5 623	75	90	8 836
Slovakia	1 933	40	0	0	2 877	275	93	4 903
Slovenia	1 253	62	21	1	740	28	13	2 027
Spain	18 173	36	9 574	19	22 171	342	618	50 537
Svalbard and Jan Mayen Islands	0	0	0	0	6 100	0	40	6 140
Sweden	28 203	69	3 044	7	9 786	530	3 996	45 029
Switzerland	1 240	31	71	2	2 689	–	128	4 128
The former Yugoslav Republic of Macedonia	998	39	143	6	1 402	–	28	2 571
Ukraine	9 705	17	41	n.s.	48 192	907	2 417	60 355
United Kingdom	2 881	12	20	n.s.	21 349	22	167	24 417
Europe	**1 005 001**	**45**	**99 477**	**4**	**1 110 249**	**10 228**	**91 549**	**2 306 276**
Anguilla	6	60	0	0	4	–	0	9
Antigua and Barbuda	10	22	16	35	19	–	0	44
Aruba	n.s.	2	0	0	18	–	0	18
Bahamas	515	51	36	4	450	–	387	1 388
Barbados	8	19	1	2	34	–	0	43
Bermuda	1	20	0	0	4	–	0	5
British Virgin Islands	4	24	2	11	10	–	0	15
Cayman Islands	13	50	0	0	13	–	n.s.	26
Cuba	2 870	26	299	3	7 813	–	104	11 086
Dominica	45	60	n.s.	n.s.	30	–	0	75
Dominican Republic	1 972	41	436	9	2 431	414	35	4 874
Grenada	17	50	1	4	16	n.s.	0	34
Guadeloupe	64	39	3	2	95	–	2	163
Haiti	101	4	0	0	2 655	–	19	2 775
Jamaica	337	31	188	17	558	83	16	1 099
Martinique	49	46	1	1	56	5	4	110
Montserrat	3	24	2	16	6	–	0	10
Netherlands Antilles	1	1	33	41	46	–	0	80
Puerto Rico	552	62	0	0	335	–	8	895
Saint Kitts and Nevis	11	42	2	8	13	n.s.	0	26
Saint Lucia	47	77	0	0	14	n.s.	1	62
Saint Martin (French part)	1	19	1	19	3	–	n.s.	5
Saint Vincent and the Grenadines	27	68	0	0	12	3	0	39
Saint Barthélemy	0	0	1	24	2	–	0	2
Trinidad and Tobago	226	44	84	16	203	37	0	513
Turks and Caicos Islands	34	80	0	0	9	–	0	43
United States Virgin Islands	20	58	0	0	14	–	0	35
Caribbean	**6 933**	**30**	**1 103**	**5**	**14 862**	**543**	**576**	**23 474**
Belize	1 393	61	113	5	775	–	16	2 297
Costa Rica	2 605	51	12	n.s.	2 489	–	4	5 110
El Salvador	287	14	204	10	1 581	180	32	2 104
Guatemala	3 657	34	1 672	15	5 514	139	46	10 889
Honduras	5 192	46	1 475	13	4 522	–	20	11 209
Nicaragua	3 114	26	2 219	18	6 807	–	860	13 000
Panama	3 251	44	821	11	3 371	760	109	7 552
Central America	**19 499**	**38**	**6 516**	**13**	**25 059**	**1 079**	**1 087**	**52 161**

TABLE 2 (continued)
Extent of forest and other wooded land 2010

Country/area	Land area						Inland water (1 000 ha)	Country area (1 000 ha)
	Forest		Other wooded land		Other land (1 000 ha)			
	1 000 ha	% of land area	1 000 ha	% of land area	Total	of which with tree cover		
Canada	310 134	34	91 951	10	507 266	–	89 116	998 467
Greenland	n.s.	n.s.	8	n.s.	41 037	0	0	41 045
Mexico	64 802	33	20 181	10	109 412	–	2 043	196 438
Saint Pierre and Miquelon	3	13	0	0	20	–	1	24
United States of America	304 022	33	14 933	2	597 238	26 993	47 011	963 204
North America	**678 961**	**33**	**127 073**	**6**	**1 254 973**	**26 993**	**138 171**	**2 199 178**
North and Central America	**705 393**	**33**	**134 692**	**6**	**1 294 895**	**28 615**	**139 834**	**2 274 813**
American Samoa	18	89	0	0	2	–	0	20
Australia	149 300	19	135 367	18	483 561	–	5 892	774 120
Cook Islands	16	65	0	0	9	–	0	24
Fiji	1 014	56	78	4	735	66	0	1 827
French Polynesia	155	42	0	0	211	50	34	400
Guam	26	47	0	0	29	–	0	55
Kiribati	12	15	0	0	69	65	0	81
Marshall Islands	13	70	0	0	5	–	0	18
Micronesia (Federated States of)	64	92	0	0	6	–	n.s.	70
Nauru	0	0	0	0	2	–	0	2
New Caledonia	839	46	371	20	618	–	30	1 858
New Zealand	8 269	31	2 557	10	15 945	–	0	26 771
Niue	19	72	0	0	7	–	0	26
Norfolk Island	n.s.	12	0	0	4	–	0	4
Northern Mariana Islands	30	66	0	0	16	–	0	46
Palau	40	88	0	0	6	–	0	46
Papua New Guinea	28 726	63	4 474	10	12 086	–	998	46 284
Pitcairn	4	83	1	12	n.s.	0	0	4
Samoa	171	60	22	8	90	63	1	284
Solomon Islands	2 213	79	129	5	457	–	91	2 890
Tokelau	0	0	0	0	1	–	0	1
Tonga	9	13	0	0	63	57	3	75
Tuvalu	1	33	0	0	2	–	0	3
Vanuatu	440	36	476	39	304	–	0	1 220
Wallis and Futuna Islands	6	42	2	11	7	5	0	14
Oceania	**191 384**	**23**	**143 476**	**17**	**514 234**	**306**	**7 049**	**856 143**
Argentina	29 400	11	61 471	22	182 798	–	4 371	278 040
Bolivia (Plurinational State of)	57 196	53	2 473	2	48 769	–	1 420	109 858
Brazil	519 522	62	43 772	5	269 218	–	18 975	851 487
Chile	16 231	22	14 658	20	43 991	0	783	75 663
Colombia	60 499	55	22 727	20	27 724	–	3 225	114 175
Ecuador	9 865	36	1 519	5	16 300	–	672	28 356
Falkland Islands (Malvinas)*	0	0	0	0	1 217	0	0	1 217
French Guiana	8 082	98	0	0	138	0	176	8 396
Guyana	15 205	77	3 580	18	900	–	1 812	21 497
Paraguay	17 582	44	0	0	22 148	–	945	40 675
Peru	67 992	53	22 132	17	37 876	700	522	128 522
Suriname	14 758	95	0	0	842	0	727	16 327
Uruguay	1 744	10	4	n.s.	15 754	13	120	17 622
Venezuela (Bolivarian Republic of)	46 275	52	7 317	8	34 613	–	3 000	91 205
South America	**864 351**	**49**	**179 653**	**10**	**702 288**	**713**	**36 748**	**1 783 040**
World	**4 033 060**	**31**	**1 144 687**	**9**	**7 832 762**	**79 110**	**423 723**	**13 434 232**

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 3
Trends in extent of forest 1990–2010

Country/area	Forest area (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%[a]	1 000 ha/yr	%[a]	1 000 ha/yr	%[a]
Angola	60 976	59 728	59 104	58 480	-125	-0.21	-125	-0.21	-125	-0.21
Botswana	13 718	12 535	11 943	11 351	-118	-0.90	-118	-0.96	-118	-1.01
Comoros	12	8	5	3	n.s.	-3.97	-1	-8.97	n.s.	-9.71
Djibouti	6	6	6	6	0	0	0	0	0	0
Eritrea	1 621	1 576	1 554	1 532	-5	-0.28	-4	-0.28	-4	-0.28
Ethiopia	15 114	13 705	13 000	12 296	-141	-0.97	-141	-1.05	-141	-1.11
Kenya	3 708	3 582	3 522	3 467	-13	-0.35	-12	-0.34	-11	-0.31
Lesotho	40	42	43	44	n.s.	0.49	n.s.	0.47	n.s.	0.46
Madagascar	13 692	13 122	12 838	12 553	-57	-0.42	-57	-0.44	-57	-0.45
Malawi	3 896	3 567	3 402	3 237	-33	-0.88	-33	-0.94	-33	-0.99
Mauritius	39	39	35	35	n.s.	-0.03	-1	-2.05	n.s.	0.06
Mayotte	18	16	15	14	n.s.	-1.15	n.s.	-1.26	n.s.	-1.35
Mozambique	43 378	41 188	40 079	39 022	-219	-0.52	-222	-0.54	-211	-0.53
Namibia	8 762	8 032	7 661	7 290	-73	-0.87	-74	-0.94	-74	-0.99
Réunion	87	87	85	88	0	0	n.s.	-0.46	1	0.70
Seychelles	41	41	41	41	0	0	0	0	0	0
Somalia	8 282	7 515	7 131	6 747	-77	-0.97	-77	-1.04	-77	-1.10
South Africa	9 241	9 241	9 241	9 241	0	0	0	0	0	0
Swaziland	472	518	541	563	5	0.93	5	0.87	4	0.80
Uganda	4 751	3 869	3 429	2 988	-88	-2.03	-88	-2.39	-88	-2.72
United Republic of Tanzania	41 495	37 462	35 445	33 428	-403	-1.02	-403	-1.10	-403	-1.16
Zambia	52 800	51 134	50 301	49 468	-167	-0.32	-167	-0.33	-167	-0.33
Zimbabwe	22 164	18 894	17 259	15 624	-327	-1.58	-327	-1.79	-327	-1.97
Eastern and Southern Africa	**304 312**	**285 906**	**276 679**	**267 517**	**-1 841**	**-0.62**	**-1 845**	**-0.65**	**-1 832**	**-0.67**
Algeria	1 667	1 579	1 536	1 492	-9	-0.54	-9	-0.55	-9	-0.58
Egypt	44	59	67	70	2	2.98	2	2.58	1	0.88
Libyan Arab Jamahiriya	217	217	217	217	0	0	0	0	0	0
Mauritania	415	317	267	242	-10	-2.66	-10	-3.37	-5	-1.95
Morocco	5 049	5 017	5 081	5 131	-3	-0.06	13	0.25	10	0.20
Sudan	76 381	70 491	70 220	69 949	-589	-0.80	-54	-0.08	-54	-0.08
Tunisia	643	837	924	1 006	19	2.67	17	2.0	16	1.72
Western Sahara	707	707	707	707	0	0	0	0	0	0
Northern Africa	**85 123**	**79 224**	**79 019**	**78 814**	**-590**	**-0.72**	**-41**	**-0.05**	**-41**	**-0.05**
Benin	5 761	5 061	4 811	4 561	-70	-1.29	-50	-1.01	-50	-1.06
Burkina Faso	6 847	6 248	5 949	5 649	-60	-0.91	-60	-0.98	-60	-1.03
Burundi	289	198	181	172	-9	-3.71	-3	-1.78	-2	-1.01
Cameroon	24 316	22 116	21 016	19 916	-220	-0.94	-220	-1.02	-220	-1.07
Cape Verde	58	82	84	85	2	3.58	n.s.	0.36	n.s.	0.36
Central African Republic	23 203	22 903	22 755	22 605	-30	-0.13	-30	-0.13	-30	-0.13
Chad	13 110	12 317	11 921	11 525	-79	-0.62	-79	-0.65	-79	-0.67
Congo	22 726	22 556	22 471	22 411	-17	-0.08	-17	-0.08	-12	-0.05
Côte d'Ivoire	10 222	10 328	10 405	10 403	11	0.10	15	0.15	n.s.	n.s.
Democratic Republic of the Congo	160 363	157 249	155 692	154 135	-311	-0.20	-311	-0.20	-311	-0.20
Equatorial Guinea	1 860	1 743	1 685	1 626	-12	-0.65	-12	-0.67	-12	-0.71
Gabon	22 000	22 000	22 000	22 000	0	0	0	0	0	0
Gambia	442	461	471	480	2	0.42	2	0.43	2	0.38
Ghana	7 448	6 094	5 517	4 940	-135	-1.99	-115	-1.97	-115	-2.19
Guinea	7 264	6 904	6 724	6 544	-36	-0.51	-36	-0.53	-36	-0.54
Guinea-Bissau	2 216	2 120	2 072	2 022	-10	-0.44	-10	-0.46	-10	-0.49
Liberia	4 929	4 629	4 479	4 329	-30	-0.63	-30	-0.66	-30	-0.68
Mali	14 072	13 281	12 885	12 490	-79	-0.58	-79	-0.60	-79	-0.62

TABLE 3 (continued)
Trends in extent of forest 1990–2010

Country/area	Forest area (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%[a]	1 000 ha/yr	%[a]	1 000 ha/yr	%[a]
Niger	1 945	1 328	1 266	1 204	-62	-3.74	-12	-0.95	-12	-1.00
Nigeria	17 234	13 137	11 089	9 041	-410	-2.68	-410	-3.33	-410	-4.00
Rwanda	318	344	385	435	3	0.79	8	2.28	10	2.47
Saint Helena, Ascension and Tristan da Cunha	2	2	2	2	0	0	0	0	0	0
Sao Tome and Principe	27	27	27	27	0	0	0	0	0	0
Senegal	9 348	8 898	8 673	8 473	-45	-0.49	-45	-0.51	-40	-0.47
Sierra Leone	3 118	2 922	2 824	2 726	-20	-0.65	-20	-0.68	-20	-0.70
Togo	685	486	386	287	-20	-3.37	-20	-4.50	-20	-5.75
Western and Central Africa	**359 803**	**343 434**	**335 770**	**328 088**	**-1 637**	**-0.46**	**-1 533**	**-0.45**	**-1 536**	**-0.46**
Africa	**749 238**	**708 564**	**691 468**	**674 419**	**-4 067**	**-0.56**	**-3 419**	**-0.49**	**-3 410**	**-0.50**
China	157 141	177 000	193 044	206 861	1 986	1.20	3 209	1.75	2 763	1.39
Democratic People's Republic of Korea	8 201	6 933	6 299	5 666	-127	-1.67	-127	-1.90	-127	-2.10
Japan	24 950	24 876	24 935	24 979	-7	-0.03	12	0.05	9	0.04
Mongolia	12 536	11 717	11 308	10 898	-82	-0.67	-82	-0.71	-82	-0.74
Republic of Korea	6 370	6 288	6 255	6 222	-8	-0.13	-7	-0.11	-7	-0.11
East Asia	**209 198**	**226 815**	**241 841**	**254 626**	**1 762**	**0.81**	**3 005**	**1.29**	**2 557**	**1.04**
Bangladesh	1 494	1 468	1 455	1 442	-3	-0.18	-3	-0.18	-3	-0.18
Bhutan	3 035	3 141	3 195	3 249	11	0.34	11	0.34	11	0.34
Brunei Darussalam	413	397	389	380	-2	-0.39	-2	-0.41	-2	-0.47
Cambodia	12 944	11 546	10 731	10 094	-140	-1.14	-163	-1.45	-127	-1.22
India	63 939	65 390	67 709	68 434	145	0.22	464	0.70	145	0.21
Indonesia	118 545	99 409	97 857	94 432	-1 914	-1.75	-310	-0.31	-685	-0.71
Lao People's Democratic Republic	17 314	16 532	16 142	15 751	-78	-0.46	-78	-0.48	-78	-0.49
Malaysia	22 376	21 591	20 890	20 456	-79	-0.36	-140	-0.66	-87	-0.42
Maldives	1	1	1	1	0	0	0	0	0	0
Myanmar	39 218	34 868	33 321	31 773	-435	-1.17	-309	-0.90	-310	-0.95
Nepal	4 817	3 900	3 636	3 636	-92	-2.09	-53	-1.39	0	0
Pakistan	2 527	2 116	1 902	1 687	-41	-1.76	-43	-2.11	-43	-2.37
Philippines	6 570	7 117	7 391	7 665	55	0.80	55	0.76	55	0.73
Singapore	2	2	2	2	0	0	0	0	0	0
Sri Lanka	2 350	2 082	1 933	1 860	-27	-1.20	-30	-1.47	-15	-0.77
Thailand	19 549	19 004	18 898	18 972	-55	-0.28	-21	-0.11	15	0.08
Timor-Leste	966	854	798	742	-11	-1.22	-11	-1.35	-11	-1.44
Viet Nam	9 363	11 725	13 077	13 797	236	2.28	270	2.21	144	1.08
South and Southeast Asia	**325 423**	**301 143**	**299 327**	**294 373**	**-2 428**	**-0.77**	**-363**	**-0.12**	**-991**	**-0.33**
Afghanistan	1 350	1 350	1 350	1 350	0	0	0	0	0	0
Armenia	347	304	283	262	-4	-1.31	-4	-1.42	-4	-1.53
Azerbaijan	936	936	936	936	0	0	0	0	0	0
Bahrain	n.s.	n.s.	n.s.	1	n.s.	5.56	n.s.	3.84	n.s.	3.26
Cyprus	161	172	173	173	1	0.63	n.s.	0.14	n.s.	0.04
Georgia	2 779	2 768	2 755	2 742	-1	-0.04	-3	-0.09	-3	-0.09
Iran (Islamic Republic of)	11 075	11 075	11 075	11 075	0	0	0	0	0	0
Iraq	804	818	825	825	1	0.17	1	0.17	0	0
Israel	132	153	155	154	2	1.49	n.s.	0.26	n.s.	-0.13
Jordan	98	98	98	98	0	0	0	0	0	0
Kazakhstan	3 422	3 365	3 337	3 309	-6	-0.17	-6	-0.17	-6	-0.17
Kuwait	3	5	6	6	n.s.	3.46	n.s.	2.73	n.s.	2.40
Kyrgyzstan	836	858	869	954	2	0.26	2	0.26	17	1.87
Lebanon	131	131	137	137	0	0	1	0.83	n.s.	0.06

TABLE 3 (continued)
Trends in extent of forest 1990–2010

Country/area	Forest area (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%[a]	1 000 ha/yr	%[a]	1 000 ha/yr	%[a]
Occupied Palestinian Territory	9	9	9	9	0	0	n.s.	0.20	0	0
Oman	2	2	2	2	0	0	0	0	0	0
Qatar	0	0	0	0	0	–	0	–	0	–
Saudi Arabia	977	977	977	977	0	0	0	0	0	0
Syrian Arab Republic	372	432	461	491	6	1.51	6	1.31	6	1.27
Tajikistan	408	410	410	410	n.s.	0.05	0	0	0	0
Turkey	9 680	10 146	10 740	11 334	47	0.47	119	1.14	119	1.08
Turkmenistan	4 127	4 127	4 127	4 127	0	0	0	0	0	0
United Arab Emirates	245	310	312	317	7	2.38	n.s.	0.13	1	0.34
Uzbekistan	3 045	3 212	3 295	3 276	17	0.54	17	0.51	-4	-0.12
Yemen	549	549	549	549	0	0	0	0	0	0
Western and Central Asia	**41 489**	**42 207**	**42 880**	**43 513**	**72**	**0.17**	**135**	**0.32**	**127**	**0.29**
Asia	**576 110**	**570 164**	**584 048**	**592 512**	**-595**	**-0.10**	**2 777**	**0.48**	**1 693**	**0.29**
Albania	789	769	782	776	-2	-0.26	3	0.34	-1	-0.15
Andorra	16	16	16	16	0	0	0	0	0	0
Austria	3 776	3 838	3 862	3 887	6	0.16	5	0.12	5	0.13
Belarus	7 780	8 273	8 436	8 630	49	0.62	33	0.39	39	0.46
Belgium	677	667	673	678	-1	-0.15	1	0.16	1	0.15
Bosnia and Herzegovina	2 210	2 185	2 185	2 185	-3	-0.11	0	0	0	0
Bulgaria	3 327	3 375	3 651	3 927	5	0.14	55	1.58	55	1.47
Croatia	1 850	1 885	1 903	1 920	4	0.19	4	0.19	3	0.18
Czech Republic	2 629	2 637	2 647	2 657	1	0.03	2	0.08	2	0.08
Denmark	445	486	534	544	4	0.89	10	1.90	2	0.37
Estonia	2 090	2 243	2 252	2 217	15	0.71	2	0.08	-7	-0.31
Faroe Islands	n.s.	n.s.	n.s.	n.s.	0	0	0	0	0	0
Finland	21 889	22 459	22 157	22 157	57	0.26	-60	-0.27	0	0
France	14 537	15 353	15 714	15 954	82	0.55	72	0.47	48	0.30
Germany	10 741	11 076	11 076	11 076	34	0.31	0	0	0	0
Gibraltar	0	0	0	0	0	–	0	–	0	–
Greece	3 299	3 601	3 752	3 903	30	0.88	30	0.82	30	0.79
Guernsey	n.s.	n.s.	n.s.	n.s.	0	0	0	0	0	0
Holy See	0	0	0	0	0	–	0	–	0	–
Hungary	1 801	1 907	1 983	2 029	11	0.57	15	0.78	9	0.46
Iceland	9	18	25	30	1	7.78	1	6.66	1	3.32
Ireland	465	635	695	739	17	3.16	12	1.82	9	1.24
Isle of Man	3	3	3	3	0	0	0	0	0	0
Italy	7 590	8 369	8 759	9 149	78	0.98	78	0.92	78	0.88
Jersey	1	1	1	1	0	0	0	0	0	0
Latvia	3 173	3 241	3 297	3 354	7	0.21	11	0.34	11	0.34
Liechtenstein	7	7	7	7	n.s.	0.60	0	0	0	0
Lithuania	1 945	2 020	2 121	2 160	8	0.38	20	0.98	8	0.37
Luxembourg	86	87	87	87	n.s.	0.11	0	0	0	0
Malta	n.s.	n.s.	n.s.	n.s.	0	0	0	0	0	0
Monaco	0	0	0	0	0	–	0	–	0	–
Montenegro	543	543	543	543	0	0	0	0	0	0
Netherlands	345	360	365	365	2	0.43	1	0.28	0	0
Norway	9 130	9 301	9 683	10 065	17	0.19	76	0.81	76	0.78
Poland	8 881	9 059	9 200	9 337	18	0.20	28	0.31	27	0.30
Portugal	3 327	3 420	3 437	3 456	9	0.28	3	0.10	4	0.11
Republic of Moldova	319	324	363	386	1	0.16	8	2.30	5	1.24
Romania	6 371	6 366	6 391	6 573	-1	-0.01	5	0.08	36	0.56

TABLE 3 (continued)
Trends in extent of forest 1990–2010

Country/area	Forest area (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%[a]	1 000 ha/yr	%[a]	1 000 ha/yr	%[a]
Russian Federation	808 950	809 269	808 790	809 090	32	n.s.	-96	-0.01	60	0.01
San Marino	0	0	0	0	0	–	0	–	0	–
Serbia	2 313	2 460	2 476	2 713	15	0.62	3	0.13	47	1.85
Slovakia	1 922	1 921	1 932	1 933	n.s.	-0.01	2	0.11	n.s.	0.01
Slovenia	1 188	1 233	1 243	1 253	5	0.37	2	0.16	2	0.16
Spain	13 818	16 988	17 293	18 173	317	2.09	61	0.36	176	1. 0
Svalbard and Jan Mayen Islands	0	0	0	0	0	–	0	–	0	–
Sweden	27 281	27 389	28 203	28 203	11	0.04	163	0.59	0	0
Switzerland	1 151	1 194	1 217	1 240	4	0.37	5	0.38	5	0.38
The former Yugoslav Republic of Macedonia	912	958	975	998	5	0.49	3	0.35	5	0.47
Ukraine	9 274	9 510	9 575	9 705	24	0.25	13	0.14	26	0.27
United Kingdom	2 611	2 793	2 845	2 881	18	0.68	10	0.37	7	0.25
Europe	**989 471**	**998 239**	**1 001 150**	**1 005 001**	**877**	**0.09**	**582**	**0.06**	**770**	**0.08**
Anguilla	6	6	6	6	0	0	0	0	0	0
Antigua and Barbuda	10	10	10	10	n.s.	-0.30	n.s.	-0.40	0	0
Aruba	n.s.	n.s.	n.s.	n.s.	0	0	0	0	0	0
Bahamas	515	515	515	515	0	0	0	0	0	0
Barbados	8	8	8	8	0	0	0	0	0	0
Bermuda	1	1	1	1	0	0	0	0	0	0
British Virgin Islands	4	4	4	4	n.s.	-0.11	n.s.	-0.05	n.s.	-0.11
Cayman Islands	13	13	13	13	0	0	0	0	0	0
Cuba	2 058	2 435	2 697	2 870	38	1.70	52	2.06	35	1.25
Dominica	50	47	46	45	n.s.	-0.55	n.s.	-0.57	n.s.	-0.59
Dominican Republic	1 972	1 972	1 972	1 972	0	0	0	0	0	0
Grenada	17	17	17	17	0	0	0	0	0	0
Guadeloupe	67	65	64	64	n.s.	-0.30	n.s.	-0.31	n.s.	-0.28
Haiti	116	109	105	101	-1	-0.62	-1	-0.74	-1	-0.77
Jamaica	345	341	339	337	n.s.	-0.11	n.s.	-0.10	n.s.	-0.12
Martinique	49	49	49	49	0	0	0	0	0	0
Montserrat	4	3	3	3	n.s.	-3.31	0	0	0	0
Netherlands Antilles	1	1	1	1	0	0	0	0	0	0
Puerto Rico	287	464	508	552	18	4.92	9	1.83	9	1.68
Saint Kitts and Nevis	11	11	11	11	0	0	0	0	0	0
Saint Lucia	44	47	47	47	n.s.	0.64	n.s.	0.13	0	0
Saint Martin (French part)	1	1	1	1	0	0	0	0	0	0
Saint Vincent and the Grenadines	25	26	26	27	n.s.	0.27	n.s.	0.23	n.s.	0.30
Saint Barthélemy	0[b]	0	0	0	0	–	0	–	0	–
Trinidad and Tobago	241	234	230	226	-1	-0.30	-1	-0.31	-1	-0.32
Turks and Caicos Islands	34	34	34	34	0	0	0	0	0	0
United States Virgin Islands	24	22	21	20	n.s.	-0.73	n.s.	-0.78	n.s.	-0.81
Caribbean	**5 902**	**6 434**	**6 728**	**6 933**	**53**	**0.87**	**59**	**0.90**	**41**	**0.60**
Belize	1 586	1 489	1 441	1 393	-10	-0.63	-10	-0.65	-10	-0.68
Costa Rica	2 564	2 376	2 491	2 605	-19	-0.76	23	0.95	23	0.90
El Salvador	377	332	309	287	-5	-1.26	-5	-1.43	-4	-1.47
Guatemala	4 748	4 208	3 938	3 657	-54	-1.20	-54	-1.32	-56	-1.47
Honduras	8 136	6 392	5 792	5 192	-174	-2.38	-120	-1.95	-120	-2.16
Nicaragua	4 514	3 814	3 464	3 114	-70	-1.67	-70	-1.91	-70	-2.11
Panama	3 792	3 369	3 310	3 251	-42	-1.18	-12	-0.35	-12	-0.36
Central America	**25 717**	**21 980**	**20 745**	**19 499**	**-374**	**-1.56**	**-247**	**-1.15**	**-249**	**-1.23**

TABLE 3 (continued)
Trends in extent of forest 1990–2010

Country/area	Forest area (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%[a]	1 000 ha/yr	%[a]	1 000 ha/yr	%[a]
Canada	310 134	310 134	310 134	310 134	0	0	0	0	0	0
Greenland	n.s.	n.s.	n.s.	n.s.	0	0	0	0	0	0
Mexico	70 291	66 751	65 578	64 802	-354	-0.52	-235	-0.35	-155	-0.24
Saint Pierre and Miquelon	3	3	3	3	n.s.	-0.60	n.s.	-1.28	n.s.	-0.68
United States of America	296 335	300 195	302 108	304 022	386	0.13	383	0.13	383	0.13
North America	**676 764**	**677 083**	**677 823**	**678 961**	**32**	**n.s.**	**148**	**0.02**	**228**	**0.03**
North and Central America	**708 383**	**705 497**	**705 296**	**705 393**	**-289**	**-0.04**	**-40**	**-0.01**	**19**	**n.s.**
American Samoa	18	18	18	18	n.s.	-0.19	n.s.	-0.19	n.s.	-0.19
Australia	154 500	154 920	153 920	149 300	42	0.03	-200	-0.13	-924	-0.61
Cook Islands	15	16	16	16	n.s.	0.40	0	0	0	0
Fiji	953	980	997	1 014	3	0.29	3	0.34	3	0.34
French Polynesia	55[b]	105	130	155	5	6.68	5	4.36	5	3.58
Guam	26	26	26	26	0	0	0	0	0	0
Kiribati	12	12	12	12	0	0	0	0	0	0
Marshall Islands	13	13	13	13	0	0	0	0	0	0
Micronesia (Federated States of)	64	64	64	64	n.s.	0.04	n.s.	0.04	n.s.	0.04
Nauru	0	0	0	0	0	–	0	–	0	–
New Caledonia	839	839	839	839	0	0	0	0	0	0
New Zealand	7 720	8 266	8 311	8 269	55	0.69	9	0.11	-8	-0.10
Niue	21	20	19	19	n.s.	-0.50	n.s.	-0.52	n.s.	-0.53
Norfolk Island	n.s.	n.s.	n.s.	n.s.	0	0	0	0	0	0
Northern Mariana Islands	34	32	31	30	n.s.	-0.50	n.s.	-0.52	n.s.	-0.53
Palau	38	40	40	40	n.s.	0.37	n.s.	0.36	0	0
Papua New Guinea	31 523	30 133	29 437	28 726	-139	-0.45	-139	-0.47	-142	-0.49
Pitcairn	4	4	4	4	0	0	0	0	0	0
Samoa	130	171	171	171	4	2.78	0	0	0	0
Solomon Islands	2 324	2 268	2 241	2 213	-6	-0.24	-5	-0.24	-6	-0.25
Tokelau	0	0	0	0	0	–	0	–	0	–
Tonga	9	9	9	9	0	0	0	0	0	0
Tuvalu	1	1	1	1	0	0	0	0	0	0
Vanuatu	440	440	440	440	0	0	0	0	0	0
Wallis and Futuna Islands	6	6	6	6	n.s.	0.03	n.s.	0.07	n.s.	0.03
Oceania	**198 744**	**198 381**	**196 745**	**191 384**	**-36**	**-0.02**	**-327**	**-0.17**	**-1 072**	**-0.55**
Argentina	34 793	31 861	30 599	29 400	-293	-0.88	-252	-0.81	-240	-0.80
Bolivia (Plurinational State of)	62 795	60 091	58 734	57 196	-270	-0.44	-271	-0.46	-308	-0.53
Brazil	574 839	545 943	530 494	519 522	-2 890	-0.51	-3 090	-0.57	-2 194	-0.42
Chile	15 263	15 834	16 043	16 231	57	0.37	42	0.26	38	0.23
Colombia	62 519	61 509	61 004	60 499	-101	-0.16	-101	-0.16	-101	-0.17
Ecuador	13 817	11 841	10 853	9 865	-198	-1.53	-198	-1.73	-198	-1.89
Falkland Islands (Malvinas)[c]	0	0	0	0	0	–	0	–	0	–
French Guiana	8 188	8 118	8 100	8 082	-7	-0.09	-4	-0.04	-4	-0.04
Guyana	15 205	15 205	15 205	15 205	0	0	0	0	0	0
Paraguay	21 157	19 368	18 475	17 582	-179	-0.88	-179	-0.94	-179	-0.99
Peru	70 156	69 213	68 742	67 992	-94	-0.14	-94	-0.14	-150	-0.22
Suriname	14 776	14 776	14 776	14 758	0	0	0	0	-4	-0.02
Uruguay	920	1 412	1 520	1 744	49	4.38	22	1.48	45	2.79
Venezuela (Bolivarian Republic of)	52 026	49 151	47 713	46 275	-288	-0.57	-288	-0.59	-288	-0.61
South America	**946 454**	**904 322**	**882 258**	**864 351**	**-4 213**	**-0.45**	**-4 413**	**-0.49**	**-3 581**	**-0.41**
World	**4 168 399**	**4 085 168**	**4 060 964**	**4 033 060**	**-8 323**	**-0.20**	**-4 841**	**-0.12**	**-5 581**	**-0.14**

[a] Rate of gain or loss in percent of the remaining forest area each year within the given period.
[b] FAO estimates based on information provided by these two countries for 2000 and 2005.
[c] A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 4
Forest ownership and management rights 2005 (%)

Country/area	Ownership pattern			Private ownership			Holder of management rights of public forests				
	Public ownership	Private ownership	Other	Individuals	Business entities and institutions	Local, indigenous and tribal communities	Public administration	Individuals	Business entities and Institutions	Communities	Other
Angola	100	0	0	–	–	–	100	0	0	0	0
Botswana	24	5	71	–	–	–	100	0	0	0	0
Comoros	100	0	0	–	–	–	–	–	–	–	–
Djibouti	100	0	0	–	–	–	100	0	0	0	0
Eritrea	–	–	–	–	–	–	–	–	–	–	–
Ethiopia	100	0	0	–	–	–	100	0	0	0	0
Kenya	39	61	0	n.s.	4	96	100	0	0	0	0
Lesotho	14	0	86	–	–	–	100	0	0	0	0
Madagascar	98	2	0	92	0	8	96	0	2	2	0
Malawi	–	–	–	–	–	–	–	–	–	–	–
Mauritius	58	42	0	–	–	0	100	0	0	0	0
Mayotte	61	39	0	–	–	–	100	0	0	0	0
Mozambique	100	n.s.	0	–	–	–	98	0	2	0	0
Namibia	–	–	–	–	–	–	–	–	–	–	–
Réunion	76	24	0	100	0	0	98	0	0	2	0
Seychelles	77	23	0	–	–	–	100	0	0	0	0
Somalia	–	–	–	–	–	–	–	–	–	–	–
South Africa	60	40	0	–	–	–	96	0	4	0	0
Swaziland	78	22	n.s.	–	–	–	100	0	0	0	0
Uganda	32	68	0	–	–	–	–	–	–	–	–
United Republic of Tanzania	100	n.s.	0	–	–	–	37	0	0	0	63
Zambia	100	0	0	–	–	–	24	7	3	61	4
Zimbabwe	63	37	0	–	–	–	52	0	4	25	18
Eastern and Southern Africa	–	–	–	–	–	–	–	–	–	–	–
Algeria	76	24	0	–	–	–	100	0	0	0	0
Egypt	50	50	0	–	–	–	100	0	0	0	0
Libyan Arab Jamahiriya	–	–	–	–	–	–	–	–	–	–	–
Mauritania	97	3	0	100	–	–	99	0	0	1	0
Morocco	99	1	0	–	–	–	100	0	0	0	0
Sudan	91	9	0	96	2	2	100	0	0	0	0
Tunisia	94	6	0	100	–	–	100	0	0	0	0
Western Sahara	–	–	–	–	–	–	–	–	–	–	–
Northern Africa	–	–	–	–	–	–	–	–	–	–	–
Benin	99	1	0	59	–	–	100	0	0	0	0
Burkina Faso	100	0	0	–	–	–	100	0	0	0	0
Burundi	100	0	0	–	–	–	100	0	0	0	0
Cameroon	100	0	0	–	–	–	56	0	41	3	0
Cape Verde	100	0	0	–	–	–	100	0	0	0	0
Central African Republic	91	0	9	–	–	–	1	0	15	0	84
Chad	100	0	0	–	–	–	100	0	0	0	0
Congo	100	0	0	–	–	–	42	0	58	0	0
Côte d'Ivoire	99	1	0	–	–	–	–	–	–	–	–
Democratic Republic of the Congo	100	0	0	–	–	–	90	0	10	0	0
Equatorial Guinea	100	0	0	–	–	–	87	1	9	3	0
Gabon	100	0	0	–	–	–	100	0	0	0	0
Gambia	94	6	0	0	0	100	100	0	0	0	0

TABLE 4 (continued)
Forest ownership and management rights 2005 (%)

Country/area	Ownership pattern			Private ownership			Holder of management rights of public forests				
	Public ownership	Private ownership	Other	Individuals	Business entities and institutions	Local, indigenous and tribal communities	Public administration	Individuals	Business entities and Institutions	Communities	Other
Ghana	100	0	0	–	–	–	–	–	–	–	–
Guinea	99	1	0	1	–	99	100	0	0	n.s.	0
Guinea-Bissau	100	0	0	–	–	–	–	–	–	–	–
Liberia	100	0	0	–	–	–	–	–	–	–	–
Mali	100	n.s.	0	100	0	0	100	0	0	0	0
Niger	100	n.s.	0	100	0	0	100	0	0	0	0
Nigeria	100	0	0	–	–	–	–	–	–	–	–
Rwanda	79	21	0	100	0	0	100	0	0	0	0
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–	–	–	–	–	–
Sao Tome and Principe	–	–	–	–	–	–	–	–	–	–	–
Senegal	100	n.s.	0	18	82	0	100	0	n.s.	n.s.	0
Sierra Leone	14	86	0	0	0	100	100	0	0	0	0
Togo	27	73	0	100	0	0	–	–	–	–	–
Western and Central Africa	–	–	–	–	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–	–	–	–	–
China	68	32	0	–	–	–	100	0	0	0	0
Democratic People's Republic of Korea	100	0	0	–	–	–	–	–	–	–	–
Japan	41	59	0	98	–	–	86	0	0	14	0
Mongolia	100	0	0	–	–	–	97	0	1	2	0
Republic of Korea	31	69	0	–	–	–	97	n.s.	1	1	n.s.
East Asia	–	–	–	–	–	–	–	–	–	–	–
Bangladesh	62	36	2	33	0	67	–	–	–	–	–
Bhutan	100	n.s.	0	100	0	0	100	0	0	0	0
Brunei Darussalam	100	0	0	–	–	–	100	0	0	0	0
Cambodia	100	0	0	–	–	–	–	–	–	2	–
India	86	14	0	–	–	–	63	0	0	37	0
Indonesia	91	9	0	–	–	–	43	n.s.	57	n.s.	0
Lao People's Democratic Republic	100	0	0	–	–	–	–	–	–	–	–
Malaysia	98	2	0	–	–	–	90	0	10	0	0
Maldives	–	–	–	–	–	–	–	–	–	–	–
Myanmar	100	n.s.	0	0	0	100	–	–	–	–	–
Nepal	100	n.s.	0	–	–	–	66	0	1	33	0
Pakistan	66	34	0	–	–	–	–	–	–	–	–
Philippines	85	15	0	–	–	–	32	n.s.	20	47	0
Singapore	100	0	0	–	–	–	100	0	0	0	0
Sri Lanka	93	7	0	–	–	–	100	0	0	0	0
Thailand	88	12	0	–	–	–	–	–	–	–	–
Timor-Leste	33	67	0	–	–	–	0	0	0	100	0
Viet Nam	72	24	4	–	–	–	–	–	–	–	–
South and Southeast Asia	–	–	–	–	–	–	–	–	–	–	–
Afghanistan	100	0	0	–	–	–	–	–	–	–	–
Armenia	100	0	0	–	–	–	–	–	–	–	–
Azerbaijan	100	0	0	–	–	–	–	–	–	–	–
Bahrain	100	0	0	–	–	–	–	–	–	–	–
Cyprus	69	31	0	–	–	0	100	0	0	0	0

TABLE 4 (continued)
Forest ownership and management rights 2005 (%)

Country/area	Ownership pattern			Private ownership			Holder of management rights of public forests				
	Public ownership	Private ownership	Other	Individuals	Business entities and institutions	Local, indigenous and tribal communities	Public administration	Individuals	Business entities and Institutions	Communities	Other
Georgia	100	0	0	–	–	–	100	0	0	0	0
Iran (Islamic Republic of)	100	0	0	–	–	–	–	–	–	–	–
Iraq	100	0	0	–	–	–	100	0	0	0	0
Israel	98	2	0	67	33	0	100	0	0	0	0
Jordan	89	11	0	–	–	–	99	0	1	0	0
Kazakhstan	100	0	0	–	–	–	–	–	–	–	–
Kuwait	100	0	0	–	–	–	–	–	–	–	–
Kyrgyzstan	100	0	0	–	–	–	99	0	0	1	0
Lebanon	27	72	1	49	36	16	100	0	0	0	0
Occupied Palestinian Territory	–	–	–	–	–	–	–	–	–	–	–
Oman	100	0	0	–	–	–	100	0	0	0	0
Qatar	–	–	–	–	–	–	–	–	–	–	–
Saudi Arabia	98	2	0	–	–	–	100	0	0	0	0
Syrian Arab Republic	100	0	0	–	–	–	100	0	0	0	0
Tajikistan	88	0	12	–	–	–	100	0	0	0	0
Turkey	100	n.s.	n.s.	95	5	n.s.	97	3	0	n.s.	n.s.
Turkmenistan	100	0	0	–	–	–	–	–	–	–	–
United Arab Emirates	100	0	0	–	–	–	100	0	0	0	0
Uzbekistan	100	0	0	–	–	–	100	0	0	0	0
Yemen	5	95	0	84	16	0	100	0	0	0	0
Western and Central Asia	–	–	–	–	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–	–	–	–	–
Albania	98	2	0	100	0	0	72	0	0	28	0
Andorra	–	–	–	–	–	–	–	–	–	–	–
Austria	19	81	0	68	20	12	100	0	0	0	0
Belarus	100	0	0	–	–	–	100	0	0	0	0
Belgium	44	56	0	85	15	0	100	0	0	0	0
Bosnia and Herzegovina	79	21	0	–	–	–	–	–	–	–	–
Bulgaria	89	11	0	93	7	0	87	0	0	13	0
Croatia	73	27	0	100	0	0	100	0	0	0	0
Czech Republic	76	24	0	86	14	0	100	0	0	0	0
Denmark	30	69	1	64	36	0	100	0	0	0	0
Estonia	40	43	17	80	20	0	100	n.s.	0	0	0
Faroe Islands	–	–	–	–	–	–	–	–	–	–	–
Finland	32	68	0	84	16	0	100	0	0	0	0
France	26	74	0	84	16	0	38	0	0	62	0
Germany	53	44	4	–	–	0	100	0	0	0	0
Gibraltar	–	–	–	–	–	–	–	–	–	–	–
Greece	77	23	0	–	–	–	–	–	–	–	–
Guernsey	–	–	–	–	–	–	–	–	–	–	–
Holy See	–	–	–	–	–	–	–	–	–	–	–
Hungary	58	42	n.s.	67	17	16	100	0	0	0	0
Iceland	30	70	0	73	27	0	100	0	0	0	0
Ireland	58	42	0	–	–	–	99	0	1	0	0
Isle of Man	–	–	–	–	–	–	–	–	–	–	–
Italy	34	66	0	88	12	0	–	–	–	–	–
Jersey	–	–	–	–	–	–	–	–	–	–	–

TABLE 4 (continued)
Forest ownership and management rights 2005 (%)

Country/area	Ownership pattern			Private ownership			Holder of management rights of public forests				
	Public ownership	Private ownership	Other	Individuals	Business entities and institutions	Local, indigenous and tribal communities	Public administration	Individuals	Business entities and Institutions	Communities	Other
Latvia	54	46	n.s.	90	10	0	100	0	0	0	0
Liechtenstein	93	7	0	–	–	–	–	–	–	–	–
Lithuania	66	34	0	100	n.s.	0	100	0	0	0	0
Luxembourg	47	53	0	–	–	–	100	0	0	0	0
Malta	100	0	0	–	–	–	–	–	–	–	–
Monaco	–	–	–	–	–	–	–	–	–	–	–
Montenegro	67	33	0	–	–	–	–	–	–	–	–
Netherlands	49	51	0	–	–	0	100	0	0	0	0
Norway	14	86	0	89	8	3	98	0	0	2	0
Poland	83	17	0	94	2	4	100	0	0	0	0
Portugal	2	98	0	89	5	5	100	0	0	0	0
Republic of Moldova	100	n.s.	0	–	–	–	91	0	0	9	0
Romania	80	20	0	53	47	0	100	0	0	0	0
Russian Federation	100	0	0	–	–	–	83	0	17	0	0
San Marino	–	–	–	–	–	–	–	–	–	–	–
Serbia	51	49	0	100	0	0	100	0	0	0	0
Slovakia	52	43	6	33	8	58	100	0	0	0	0
Slovenia	26	74	0	96	0	4	100	0	0	0	0
Spain	29	66	5	97	0	3	100	0	0	0	0
Svalbard and Jan Mayen Islands	–	–	–	–	–	–	–	–	–	–	–
Sweden	24	76	0	63	29	8	100	0	0	0	0
Switzerland	68	32	0	87	13	0	7	0	15	72	7
The former Yugoslav Republic of Macedonia	90	10	0	100	0	0	100	0	0	0	0
Ukraine	100	n.s.	0	100	0	0	91	0	0	n.s.	9
United Kingdom	35	65	0	76	24	n.s.	100	0	0	0	0
Europe	–	–	–	–	–	–	–	–	–	–	–
Anguilla	–	–	–	–	–	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	–	–	–	–	–	–
Bahamas	80	20	0	–	–	–	–	–	–	–	–
Barbados	1	99	0	–	–	–	100	0	0	0	0
Bermuda	–	–	–	–	–	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–	–	–	–	–	–
Cuba	95	3	2	100	0	0	100	0	0	0	0
Dominica	–	–	–	–	–	–	–	–	–	–	–
Dominican Republic	–	–	–	–	–	–	–	–	–	–	–
Grenada	–	–	–	–	–	–	–	–	–	–	–
Guadeloupe	53	47	0	–	–	–	100	0	0	0	0
Haiti	100	0	0	–	–	–	100	0	0	0	0
Jamaica	28	65	7	–	–	–	100	0	0	0	0
Martinique	33	67	0	–	–	–	100	0	0	0	0
Montserrat	33	64	3	–	–	–	100	0	0	0	0
Netherlands Antilles	–	–	–	–	–	–	–	–	–	–	–
Puerto Rico	–	–	–	–	–	–	–	–	–	–	–
Saint Kitts and Nevis	100	0	0	–	–	–	100	0	0	0	0

TABLE 4 (continued)
Forest ownership and management rights 2005 (%)

Country/area	Ownership pattern			Private ownership			Holder of management rights of public forests				
	Public ownership	Private ownership	Other	Individuals	Business entities and institutions	Local, indigenous and tribal communities	Public administration	Individuals	Business entities and Institutions	Communities	Other
Saint Lucia	–	–	–	–	–	–	–	–	–	–	–
Saint Martin (French part)	–	–	–	–	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	–	–	–	–	–	–	–	–	–	–
Saint Barthélemy	–	–	–	–	–	–	–	–	–	–	–
Trinidad and Tobago	76	24	0	–	–	–	100	0	0	0	0
Turks and Caicos Islands	–	–	–	–	–	–	–	–	–	–	–
United States Virgin Islands	–	–	–	–	–	–	–	–	–	–	–
Caribbean	–	–	–	–	–	–	–	–	–	–	–
Belize	–	–	–	–	–	–	–	–	–	–	–
Costa Rica	45	55	0	–	–	–	100	0	0	0	0
El Salvador	31	69	0	–	–	–	100	0	0	0	0
Guatemala	42	52	5	–	–	–	100	0	0	0	0
Honduras	62	38	0	84	0	16	100	0	0	0	0
Nicaragua	11	88	2	41	2	56	–	–	–	–	–
Panama	98	2	0	100	0	0	100	0	0	0	0
Central America	–	–	–	–	–	–	–	–	–	–	–
Canada	92	8	n.s.	84	16	0	100	0	0	0	0
Greenland	100	0	0	–	–	–	100	0	0	0	0
Mexico	4	26	70	–	–	–	–	–	–	–	–
Saint Pierre and Miquelon	97	3	0	100	0	0	0	0	0	100	0
United States of America	43	57	0	69	31	0	100	0	0	0	0
North America	–	–	–	–	–	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–	–	–	–	–	–
American Samoa	–	–	–	–	–	–	–	–	–	–	–
Australia	74	24	1	–	–	–	38	0	62	0	0
Cook Islands	0	100	0	0	13	87	–	–	–	–	–
Fiji	5	95	0	6	0	94	100	0	0	0	0
French Polynesia	15	85	0	0	0	0	100	0	0	0	0
Guam	–	–	–	–	–	–	–	–	–	–	–
Kiribati	70	30	0	5	–	–	–	–	–	–	–
Marshall Islands	–	–	–	–	–	–	–	–	–	–	–
Micronesia (Federated States of)	–	–	–	–	–	–	–	–	–	–	–
Nauru	–	–	–	–	–	–	–	–	–	–	–
New Caledonia	57	43	0	37	–	–	100	0	0	0	0
New Zealand	64	36	0	–	16	–	100	0	0	0	0
Niue	–	–	–	–	–	–	–	–	–	–	–
Norfolk Island	–	–	–	–	–	–	–	–	–	–	–
Northern Mariana Islands	–	–	–	–	–	–	–	–	–	–	–
Palau	–	–	–	–	–	–	–	–	–	–	–
Papua New Guinea	3	97	0	0	0	100	96	0	4	0	0
Pitcairn	–	–	–	–	–	–	–	–	–	–	–
Samoa	21	79	0	–	–	–	–	–	–	–	–
Solomon Islands	n.s.	100	0	–	–	–	100	0	0	0	0
Tokelau	–	–	–	–	–	–	–	–	–	–	–
Tonga	56	44	0	–	–	–	80	0	20	0	0
Tuvalu	–	–	–	–	–	–	–	–	–	–	–

TABLE 4 (continued)
Forest ownership and management rights 2005 (%)

Country/area	Ownership pattern			Private ownership			Holder of management rights of public forests				
	Public ownership	Private ownership	Other	Individuals	Business entities and institutions	Local, indigenous and tribal communities	Public administration	Individuals	Business entities and Institutions	Communities	Other
Vanuatu	–	–	–	–	–	–	–	–	–	–	–
Wallis and Futuna Islands	–	–	–	–	–	–	–	–	–	–	–
Oceania	–	–	–	–	–	–	–	–	–	–	–
Argentina	–	–	–	–	–	–	–	–	–	–	–
Bolivia (Plurinational State of)	100	n.s.	0	–	–	–	85	2	10	1	1
Brazil	81	19	0	–	–	–	63	0	0	37	0
Chile	25	75	0	–	–	–	100	0	0	0	0
Colombia	22	67	11	0	0	100	100	0	0	0	0
Ecuador	15	2	83	–	–	–	–	–	–	–	–
Falkland Islands (Malvinas)*	–	–	–	–	–	–	–	–	–	–	–
French Guiana	100	n.s.	0	–	–	–	100	0	0	0	0
Guyana	80	20	0	–	–	–	100	0	0	0	0
Paraguay	39	61	0	–	–	–	100	0	0	0	0
Peru	62	18	20	–	–	–	40	0	0	0	60
Suriname	99	1	0	–	–	0	85	2	8	3	1
Uruguay	1	99	0	–	–	0	0	0	0	0	100
Venezuela (Bolivarian Republic of)	100	0	0	–	–	–	96	0	4	0	0
South America	–	–	–	–	–	–	–	–	–	–	–
World	–	–	–	–	–	–	–	–	–	–	–

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 5
Primary designated functions of forest 2010

Country/area	Total forest area (1 000 ha)	Primary designated function (%)						
		Production	Protection of soil and water	Conservation of biodiversity	Social services	Multiple use	Other	None or unknown
Angola	58 480	4	0	3	0	0	0	93
Botswana	11 351	0	0	0	0	100	0	0
Comoros	3	33	67	0	0	0	0	0
Djibouti	6	0	0	0	0	100	0	0
Eritrea	1 532	2	1	5	0	1	0	91
Ethiopia	12 296	4	0	0	0	96	0	0
Kenya	3 467	6	94	0	0	0	0	0
Lesotho	44	24	0	0	0	76	0	0
Madagascar	12 553	26	1	38	0	34	0	0
Malawi	3 237	37	0	23	0	0	0	40
Mauritius	35	30	42	19	7	2	0	0
Mayotte	14	0	31	0	0	0	0	69
Mozambique	39 022	67	22	11	0	0	0	0
Namibia	7 290	0	0	9	0	22	0	69
Réunion	88	5	3	28	1	38	0	25
Seychelles	41	1	16	5	0	14	0	64
Somalia	6 747	n.s.	0	0	0	100	0	0
South Africa	9 241	19	0	10	0	71	0	0
Swaziland	563	25	0	0	0	0	0	75
Uganda	2 988	12	0	36	15	0	0	37
United Republic of Tanzania	33 428	71	0	6	0	24	0	0
Zambia	49 468	24	0	22	0	17	0	37
Zimbabwe	15 624	10	3	5	0	82	0	0
Eastern and Southern Africa	**267 517**	**27**	**5**	**10**	**n.s.**	**27**	**0**	**31**
Algeria	1 492	35	53	12	n.s.	0	0	0
Egypt	70	2	49	3	0	46	0	0
Libyan Arab Jamahiriya	217	0	100	0	0	0	0	0
Mauritania	242	0	7	20	0	73	0	0
Morocco	5 131	21	0	12	0	67	0	0
Sudan	69 949	50	3	17	0	0	0	30
Tunisia	1 006	24	41	4	0	32	0	0
Western Sahara	707	–	–	–	–	–	–	–
Northern Africa	**78 814**	**47**	**5**	**16**	**n.s.**	**5**	**0**	**27**
Benin	4 561	31	0	28	n.s.	40	0	0
Burkina Faso	5 649	11	0	6	n.s.	84	0	0
Burundi	172	9	0	0	0	0	0	91
Cameroon	19 916	73	3	17	1	6	n.s.	0
Cape Verde	85	80	9	11	0	0	0	0
Central African Republic	22 605	21	0	1	0	78	0	0
Chad	11 525	90	n.s.	10	0	0	0	0
Congo	22 411	88	0	4	0	7	0	0
Côte d'Ivoire	10 403	89	3	8	n.s.	0	0	0
Democratic Republic of the Congo	154 135	5	0	17	0	0	0	78
Equatorial Guinea	1 626	5	0	36	3	53	3	0
Gabon	22 000	45	0	18	n.s.	36	0	0
Gambia	480	n.s.	12	9	0	5	0	73
Ghana	4 940	23	7	1	1	0	0	68
Guinea	6 544	2	9	46	0	7	0	36
Guinea-Bissau	2 022	29	12	55	3	0	0	0
Liberia	4 329	25	0	4	0	0	0	71

TABLE 5 (continued)
Primary designated functions of forest 2010

Country/area	Total forest area (1 000 ha)	Primary designated function (%)						
		Production	Protection of soil and water	Conservation of biodiversity	Social services	Multiple use	Other	None or unknown
Mali	12 490	47	6	32	0	15	0	0
Niger	1 204	1	n.s.	18	0	81	0	0
Nigeria	9 041	29	0	28	0	0	0	43
Rwanda	435	74	12	0	0	14	0	0
Saint Helena, Ascension and Tristan da Cunha	2	–	–	–	–	–	–	–
Sao Tome and Principe	27	–	–	–	–	–	–	–
Senegal	8 473	60	n.s.	18	n.s.	22	0	0
Sierra Leone	2 726	9	0	7	0	0	0	84
Togo	287	68	16	16	0	0	0	0
Western and Central Africa	**328 088**	**29**	**1**	**16**	**n.s.**	**13**	**n.s.**	**42**
Africa	**674 419**	**30**	**3**	**14**	**n.s.**	**17**	**n.s.**	**35**
China	206 861	41	29	4	2	24	0	0
Democratic People's Republic of Korea	5 666	86	0	14	0	0	0	0
Japan	24 979	17	70	0	13	0	0	0
Mongolia	10 898	7	45	47	1	0	0	0
Republic of Korea	6 222	77	5	1	9	7	0	0
East Asia	**254 626**	**39**	**33**	**6**	**3**	**19**	**0**	**0**
Bangladesh	1 442	49	8	17	1	25	0	0
Bhutan	3 249	16	46	27	0	0	0	11
Brunei Darussalam	380	58	5	21	1	0	0	15
Cambodia	10 094	33	5	39	1	4	0	17
India	68 434	25	16	29	0	30	0	0
Indonesia	94 432	53	24	16	0	0	0	7
Lao People's Democratic Republic	15 751	23	58	19	n.s.	0	0	0
Malaysia	20 456	62	13	10	0	15	0	0
Maldives	1	–	–	–	–	–	–	–
Myanmar	31 773	62	4	7	0	27	0	0
Nepal	3 636	10	12	14	0	23	0	40
Pakistan	1 687	32	0	13	0	55	0	0
Philippines	7 665	76	8	16	0	0	0	0
Singapore	2	0	0	100	0	0	0	0
Sri Lanka	1 860	9	1	30	0	60	0	0
Thailand	18 972	14	7	47	1	0	0	32
Timor-Leste	742	33	42	25	0	0	0	0
Viet Nam	13 797	47	37	16	0	0	0	0
South and Southeast Asia	**294 373**	**42**	**19**	**21**	**n.s.**	**12**	**0**	**6**
Afghanistan	1 350	0	0	0	0	100	0	0
Armenia	262	24	46	0	0	30	0	0
Azerbaijan	936	0	92	8	0	0	0	0
Bahrain	1	0	100	0	0	0	0	0
Cyprus	173	24	0	2	8	28	0	38
Georgia	2 742	0	79	8	13	0	0	0
Iran (Islamic Republic of)	11 075	14	0	1	0	85	0	0
Iraq	825	0	80	20	0	0	0	0
Israel	154	0	15	18	3	64	0	0
Jordan	98	0	98	1	1	0	0	0
Kazakhstan	3 309	0	0	16	13	71	0	0
Kuwait	6	0	100	0	0	0	0	0
Kyrgyzstan	954	0	75	9	1	15	0	0

TABLE 5 (continued)
Primary designated functions of forest 2010

Country/area	Total forest area (1 000 ha)	Primary designated function (%)						
		Production	Protection of soil and water	Conservation of biodiversity	Social services	Multiple use	Other	None or unknown
Lebanon	137	6	25	3	0	66	0	0
Occupied Palestinian Territory	9	–	–	–	–	–	–	–
Oman	2	100	0	0	0	0	0	0
Qatar	0	–	–	–	–	–	–	–
Saudi Arabia	977	0	0	0	0	100	0	0
Syrian Arab Republic	491	0	0	0	0	100	0	0
Tajikistan	410	5	11	84	0	0	0	0
Turkey	11 334	70	17	8	n.s.	6	0	0
Turkmenistan	4 127	0	97	3	0	0	0	0
United Arab Emirates	317	0	0	0	0	100	0	0
Uzbekistan	3 276	n.s.	93	6	0	0	0	0
Yemen	549	0	0	0	0	100	0	0
Western and Central Asia	**43 513**	**22**	**31**	**6**	**2**	**38**	**0**	**n.s.**
Asia	**592 512**	**39**	**26**	**13**	**2**	**17**	**0**	**3**
Albania	776	79	17	4	0	0	0	0
Andorra	16	0	0	0	0	0	0	100
Austria	3 887	60	37	3	1	0	0	0
Belarus	8 630	50	19	14	18	0	0	0
Belgium	678	0	15	31	0	55	0	0
Bosnia and Herzegovina	2 185	56	0	1	0	0	0	43
Bulgaria	3 927	73	12	1	6	8	0	0
Croatia	1 920	82	4	3	2	9	0	0
Czech Republic	2 657	75	9	13	3	0	0	0
Denmark	544	55	0	7	0	27	0	11
Estonia	2 217	66	12	9	0	13	0	0
Faroe Islands	n.s.	–	–	–	–	–	–	–
Finland	22 157	87	0	9	n.s.	4	0	0
France	15 954	75	2	1	n.s.	22	0	0
Germany	11 076	0	0	26	0	74	0	0
Gibraltar	0	–	–	–	–	–	–	–
Greece	3 903	92	0	4	0	0	0	4
Guernsey	n.s.	–	–	–	–	–	–	–
Holy See	0	–	–	–	–	–	–	–
Hungary	2 029	64	14	21	1	0	0	0
Iceland	30	20	13	n.s.	19	44	4	0
Ireland	739	43	0	11	n.s.	0	0	46
Isle of Man	3	–	–	–	–	–	–	–
Italy	9 149	45	20	36	n.s.	0	0	0
Jersey	1	–	–	–	–	–	–	–
Latvia	3 354	79	4	15	2	0	0	0
Liechtenstein	7	32	40	20	8	0	0	0
Lithuania	2 160	71	10	9	3	8	0	0
Luxembourg	87	33	0	0	0	68	0	0
Malta	n.s.	0	0	100	0	0	0	0
Monaco	0	–	–	–	–	–	–	–
Montenegro	543	64	10	5	0	0	0	21
Netherlands	365	1	0	25	0	74	0	0
Norway	10 065	60	27	2	0	11	0	0
Poland	9 337	40	20	5	11	1	5	18
Portugal	3 456	59	7	5	0	30	0	0
Republic of Moldova	386	0	10	17	26	47	0	0

TABLE 5 (continued)
Primary designated functions of forest 2010

Country/area	Total forest area (1 000 ha)	Primary designated function (%)						
		Production	Protection of soil and water	Conservation of biodiversity	Social services	Multiple use	Other	None or unknown
Romania	6 573	48	39	5	6	0	3	0
Russian Federation	809 090	51	9	2	2	10	26	0
San Marino	0	–	–	–	–	–	–	–
Serbia	2 713	89	7	5	n.s.	n.s.	0	0
Slovakia	1 933	7	18	4	12	59	0	0
Slovenia	1 253	31	6	46	6	11	0	0
Spain	18 173	20	20	12	2	46	0	0
Svalbard and Jan Mayen Islands	0	–	–	–	–	–	–	–
Sweden	28 203	74	n.s.	10	0	15	0	0
Switzerland	1 240	40	1	7	5	0	40	7
The former Yugoslav Republic of Macedonia	998	81	0	0	0	0	0	19
Ukraine	9 705	46	31	4	19	0	0	0
United Kingdom	2 881	32	n.s.	5	4	55	0	4
Europe	**1 005 001**	**52**	**9**	**4**	**2**	**11**	**21**	**n.s.**
Anguilla	6	–	–	–	–	–	–	–
Antigua and Barbuda	10	–	–	–	–	–	–	–
Aruba	n.s.	–	–	–	–	–	–	–
Bahamas	515	–	–	–	–	–	–	–
Barbados	8	0	0	4	0	0	0	96
Bermuda	1	–	–	–	–	–	–	–
British Virgin Islands	4	–	–	–	–	–	–	–
Cayman Islands	13	–	–	–	–	–	–	–
Cuba	2 870	31	47	21	n.s.	0	0	0
Dominica	45	–	–	–	–	–	–	–
Dominican Republic	1 972	–	–	–	–	–	–	–
Grenada	17	1	3	14	0	0	0	82
Guadeloupe	64	4	0	n.s.	0	49	0	46
Haiti	101	54	0	4	0	0	0	42
Jamaica	337	2	4	21	0	6	0	66
Martinique	49	3	5	12	0	n.s.	13	67
Montserrat	3	0	0	0	0	100	0	0
Netherlands Antilles	1	–	–	–	–	–	–	–
Puerto Rico	552	–	–	–	–	–	–	–
Saint Kitts and Nevis	11	0	0	0	0	100	0	0
Saint Lucia	47	0	0	5	0	19	0	76
Saint Martin (French part)	1	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	27	–	–	–	–	–	–	–
Saint Barthélemy	0	–	–	–	–	–	–	–
Trinidad and Tobago	226	34	23	9	4	32	0	0
Turks and Caicos Islands	34	–	–	–	–	–	–	–
United States Virgin Islands	20	–	–	–	–	–	–	–
Caribbean	**6 933**	**28**	**38**	**19**	**1**	**4**	**n.s.**	**10**
Belize	1 393	0	0	43	0	0	0	57
Costa Rica	2 605	14	11	24	4	15	0	32
El Salvador	287	24	5	11	0	60	0	0
Guatemala	3 657	28	0	63	0	0	0	9
Honduras	5 192	21	22	44	13	0	0	0
Nicaragua	3 114	20	6	65	0	2	1	7
Panama	3 251	14	2	41	0	43	0	0
Central America	**19 499**	**19**	**9**	**47**	**4**	**10**	**n.s.**	**11**

TABLE 5 (continued)
Primary designated functions of forest 2010

Country/area	Total forest area (1 000 ha)	Primary designated function (%)						
		Production	Protection of soil and water	Conservation of biodiversity	Social services	Multiple use	Other	None or unknown
Canada	310 134	1	0	5	0	87	0	7
Greenland	n.s.	0	0	0	0	0	100	0
Mexico	64 802	5	0	13	0	82	0	0
Saint Pierre and Miquelon	3	0	0	0	0	100	0	0
United States of America	304 022	30	0	25	0	46	0	0
North America	**678 961**	**14**	**0**	**15**	**0**	**68**	**n.s.**	**3**
North and Central America	**705 393**	**14**	**n.s.**	**16**	**n.s.**	**66**	**n.s.**	**4**
American Samoa	18	0	0	0	0	100	0	0
Australia	149 300	1	0	15	0	39	44	1
Cook Islands	16	0	7	0	0	93	0	0
Fiji	1 014	17	9	9	0	65	0	0
French Polynesia	155	4	2	5	0	0	0	90
Guam	26	0	0	0	0	100	0	0
Kiribati	12	0	0	2	0	0	0	98
Marshall Islands	13	0	0	0	0	100	0	0
Micronesia (Federated States of)	64	0	0	0	0	100	0	0
Nauru	0	–	–	–	–	–	–	–
New Caledonia	839	2	15	9	7	0	0	67
New Zealand	8 269	24	1	76	0	0	0	0
Niue	19	–	–	–	–	–	–	–
Norfolk Island	n.s.	–	–	–	–	–	–	–
Northern Mariana Islands	30	0	0	0	0	100	0	0
Palau	40	0	0	0	0	100	0	0
Papua New Guinea	28 726	25	0	5	0	5	0	66
Pitcairn	4	–	–	–	–	–	–	–
Samoa	171	47	20	17	4	5	0	7
Solomon Islands	2 213	17	28	22	n.s.	0	0	33
Tokelau	0	–	–	–	–	–	–	–
Tonga	9	11	7	82	0	0	0	0
Tuvalu	1	0	0	0	0	0	0	100
Vanuatu	440	–	–	–	–	–	–	–
Wallis and Futuna Islands	6	5	87	8	0	0	0	0
Oceania	**191 384**	**6**	**n.s.**	**16**	**n.s.**	**32**	**34**	**11**
Argentina	29 400	5	0	4	0	9	0	83
Bolivia (Plurinational State of)	57 196	0	0	19	0	81	0	n.s.
Brazil	519 522	7	8	9	23	4	0	49
Chile	16 231	46	29	14	0	11	0	0
Colombia	60 499	13	1	14	0	0	0	72
Ecuador	9 865	2	24	49	0	21	0	4
Falkland Islands (Malvinas)*	0	–	–	–	–	–	–	–
French Guiana	8 082	0	0	30	0	52	0	18
Guyana	15 205	97	0	1	2	0	0	0
Paraguay	17 582	n.s.	n.s.	11	n.s.	0	0	89
Peru	67 992	37	n.s.	27	n.s.	26	0	10
Suriname	14 758	27	0	15	0	4	0	55
Uruguay	1 744	64	21	15	0	0	0	0
Venezuela (Bolivarian Republic of)	46 275	49	17	34	0	0	0	0
South America	**864 351**	**14**	**7**	**13**	**14**	**11**	**0**	**41**
World	**4 033 060**	**30**	**8**	**12**	**4**	**24**	**7**	**16**

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 6
Forest management and legal status 2010

Country/area	Permanent forest estate		Forest within protected areas		Forest with management plan	
	1 000 ha	% of forest area	1 000 ha	% of forest area	1 000 ha	% of forest area
Angola	58 480	100	1 862	3	0	0
Botswana	420	4	–	–	–	–
Comoros	–	–	0	0	–	–
Djibouti	6	100	0	0	–	–
Eritrea	0	0	55	4	41	3
Ethiopia	–	–	–	–	–	–
Kenya	1 364	39	–	–	824	24
Lesotho	6	14	1	2	3	7
Madagascar	3 476	28	4 752	38	2	n.s.
Malawi	1 526	47	757	23	–	–
Mauritius	0	0	0	0	8	23
Mayotte	5	36	4	31	n.s.	4
Mozambique	–	–	4 143	11	901	2
Namibia	136	2	689	9	596	8
Réunion	65	74	68	77	54	61
Seychelles	–	–	2	5	–	–
Somalia	–	–	–	–	–	–
South Africa	1 463	16	947	10	2 106	23
Swaziland	–	–	–	–	107	19
Uganda	1 900	64	731	24	–	–
United Republic of Tanzania	13 000	39	2 000	6	28 577	85
Zambia	3 244	7	10 680	22	11 479	23
Zimbabwe	909	6	801	5	909	6
Eastern and Southern Africa	–	–	–	–	–	–
Algeria	1 492	100	173	12	1 325	89
Egypt	70	100	20	28	4	6
Libyan Arab Jamahiriya	–	–	–	–	–	–
Mauritania	48	20	–	–	5	2
Morocco	5 131	100	376	7	985	19
Sudan	59 400	85	13 346	19	14 855	21
Tunisia	1 006	100	71	7	518	51
Western Sahara	–	–	–	–	–	–
Northern Africa	–	–	–	–	–	–
Benin	2 700	59	1 263	28	1 741	38
Burkina Faso	3 800	67	–	–	600	11
Burundi	76	44	40	23	–	–
Cameroon	18 048	91	9 105	46	7 847	39
Cape Verde	–	–	9	11	–	–
Central African Republic	5 073	22	247	1	3 730	17
Chad	1 153	10	–	–	–	–
Congo	15 203	68	986	4	5 417	24
Côte d'Ivoire	8 535	82	808	8	2 087	20
Democratic Republic of the Congo	–	–	16 297	11	6 591	4
Equatorial Guinea	1 626	100	586	36	0	0
Gabon	10 000	45	3 434	16	7 500	34
Gambia	34	7	43	9	75	16
Ghana	4 543	92	43	1	971	20
Guinea	1 186	18	242	4	322	5
Guinea-Bissau	–	–	–	–	150	7
Liberia	1 411	33	194	4	265	6
Mali	5 200	42	3 900	31	589	5

TABLE 6 (continued)
Forest management and legal status 2010

Country/area	Permanent forest estate		Forest within protected areas		Forest with management plan	
	1 000 ha	% of forest area	1 000 ha	% of forest area	1 000 ha	% of forest area
Niger	–	–	220	18	220	18
Nigeria	4 105	45	2 509	28	3 730	41
Rwanda	–	–	62	14	–	–
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–
Sao Tome and Principe	–	–	–	–	–	–
Senegal	4 424	52	1 532	18	500	6
Sierra Leone	285	10	187	7	75	3
Togo	–	–	–	–	–	–
Western and Central Africa	–	–	–	–	–	–
Africa	–	–	–	–	–	–
China	206 861	100	24 671	12	128 500	62
Democratic People's Republic of Korea	–	–	780	14	–	–
Japan	13 149	53	13 149	53	24 979	100
Mongolia	10 898	100	5 152	47	400	4
Republic of Korea	–	–	–	–	3 041	49
East Asia	–	–	–	–	–	–
Bangladesh	1 225	85	247	17	871	60
Bhutan	1 949	60	883	27	318	10
Brunei Darussalam	322	85	19	5	–	–
Cambodia	10 094	100	3 092	31	–	–
India	46 194	68	19 774	29	30 597	45
Indonesia	77 067	82	37 811	40	–	–
Lao People's Democratic Republic	–	–	–	–	–	–
Malaysia	14 301	70	4 640	23	18 941	93
Maldives	–	–	–	–	–	–
Myanmar	–	–	2 081	7	31 273	98
Nepal	–	–	526	14	1 500	41
Pakistan	–	–	–	–	–	–
Philippines	–	–	1 804	24	2 250	29
Singapore	–	–	–	–	–	–
Sri Lanka	–	–	–	–	–	–
Thailand	16 381	86	9 426	50	16 381	86
Timor-Leste	–	–	–	–	–	–
Viet Nam	–	–	–	–	–	–
South and Southeast Asia	–	–	–	–	–	–
Afghanistan	–	–	–	–	–	–
Armenia	–	–	–	–	–	–
Azerbaijan	–	–	–	–	–	–
Bahrain	–	–	–	–	–	–
Cyprus	107	62	95	55	107	62
Georgia	0	0	551	20	58	2
Iran (Islamic Republic of)	–	–	–	–	–	–
Iraq	825	100	–	–	–	–
Israel	80	52	28	18	120	78
Jordan	98	100	35	35	–	–
Kazakhstan	–	–	–	–	–	–
Kuwait	–	–	–	–	–	–
Kyrgyzstan	850	89	80	8	850	89
Lebanon	20	15	4	3	0	0
Occupied Palestinian Territory	–	–	–	–	–	–

TABLE 6 (continued)
Forest management and legal status 2010

Country/area	Permanent forest estate		Forest within protected areas		Forest with management plan	
	1 000 ha	% of forest area	1 000 ha	% of forest area	1 000 ha	% of forest area
Oman	–	–	–	–	–	–
Qatar	–	–	–	–	–	–
Saudi Arabia	–	–	–	–	–	–
Syrian Arab Republic	491	100	100	20	250	51
Tajikistan	344	84	44	11	22	5
Turkey	11 334	100	269	2	11 334	100
Turkmenistan	–	–	–	–	–	–
United Arab Emirates	317	100	–	–	0	0
Uzbekistan	3 276	100	210	6	3 276	100
Yemen	549	100	31	6	0	0
Western and Central Asia	–	–	–	–	–	–
Asia	–	–	–	–	–	–
Albania	776	100	162	21	776	100
Andorra	–	–	–	–	–	–
Austria	3 887	100	659	17	1 944	50
Belarus	8 630	100	1 208	14	8 630	100
Belgium	–	–	209	31	360	53
Bosnia and Herzegovina	–	–	–	–	–	–
Bulgaria	3 927	100	313	8	3 927	100
Croatia	1 920	100	54	3	1 489	78
Czech Republic	2 657	100	740	28	2 657	100
Denmark	485	89	40	7	254	47
Estonia	694	31	213	10	1 530	69
Faroe Islands	–	–	–	–	–	–
Finland	–	–	1 925	9	14 497	65
France	15 954	100	313	2	6 826	43
Germany	10 568	95	2 754	25	7 528	68
Gibraltar	–	–	–	–	–	–
Greece	–	–	164	4	–	–
Guernsey	–	–	–	–	–	–
Holy See	–	–	–	–	–	–
Hungary	2 029	100	424	21	2 029	100
Iceland	0	0	n.s.	n.s.	23	77
Ireland	739	100	58	8	570	77
Isle of Man	–	–	–	–	–	–
Italy	9 030	99	3 265	36	–	–
Jersey	–	–	–	–	–	–
Latvia	1 737	52	610	18	3 354	100
Liechtenstein	–	–	4	60	7	100
Lithuania	2 160	100	433	20	2 160	100
Luxembourg	87	100	–	–	–	–
Malta	–	–	n.s.	100	n.s.	100
Monaco	–	–	–	–	–	–
Montenegro	–	–	13	2	–	–
Netherlands	3	1	83	23	226	62
Norway	421	4	167	2	4 727	47
Poland	9 337	100	187	2	8 382	90
Portugal	1 281	37	700	20	1 081	31
Republic of Moldova	–	–	64	17	–	–
Romania	6 573	100	1 746	27	5 210	79
Russian Federation	180 697	22	17 572	2	809 090	100

TABLE 6 (continued)
Forest management and legal status 2010

Country/area	Permanent forest estate		Forest within protected areas		Forest with management plan	
	1 000 ha	% of forest area	1 000 ha	% of forest area	1 000 ha	% of forest area
San Marino	–	–	–	–	–	–
Serbia	2 713	100	452	17	2 252	83
Slovakia	1 933	100	1 104	57	1 933	100
Slovenia	–	–	241	19	1 253	100
Spain	18 173	100	2 499	14	3 487	19
Svalbard and Jan Mayen Islands	–	–	–	–	–	–
Sweden	–	–	1 435	5	28 203	100
Switzerland	1 240	100	90	7	618	50
The former Yugoslav Republic of Macedonia	918	92	–	–	918	92
Ukraine	9 705	100	–	–	8 900	92
United Kingdom	2 881	100	145	5	1 870	65
Europe	–	–	–	–	–	–
Anguilla	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–
Aruba	–	–	–	–	–	–
Bahamas	–	–	–	–	–	–
Barbados	–	–	n.s.	4	–	–
Bermuda	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–
Cuba	2 870	100	634	22	2 344	82
Dominica	–	–	–	–	–	–
Dominican Republic	–	–	–	–	–	–
Grenada	–	–	2	14	–	–
Guadeloupe	34	54	14	23	34	53
Haiti	–	–	4	4	–	–
Jamaica	118	35	118	35	–	–
Martinique	16	33	2	5	10	20
Montserrat	1	46	1	46	–	–
Netherlands Antilles	–	–	–	–	–	–
Puerto Rico	–	–	–	–	–	–
Saint Kitts and Nevis	–	–	–	–	–	–
Saint Lucia	–	–	2	5	–	–
Saint Martin (French part)	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	–	–	–	–	–
Saint Barthélemy	–	–	–	–	–	–
Trinidad and Tobago	143	63	–	–	143	63
Turks and Caicos Islands	–	–	–	–	–	–
United States Virgin Islands	–	–	–	–	n.s.	2
Caribbean	–	–	–	–	–	–
Belize	–	–	–	–	–	–
Costa Rica	–	–	–	–	–	–
El Salvador	–	–	32	11	3	1
Guatemala	–	–	–	–	–	–
Honduras	–	–	2 335	45	1 076	21
Nicaragua	–	–	2 018	65	100	3
Panama	164	5	2 116	65	68	2
Central America	–	–	–	–	–	–
Canada	285 587	92	24 859	8	–	–
Greenland	n.s.	100	–	–	–	–

TABLE 6 (continued)
Forest management and legal status 2010

Country/area	Permanent forest estate		Forest within protected areas		Forest with management plan	
	1 000 ha	% of forest area	1 000 ha	% of forest area	1 000 ha	% of forest area
Mexico	–	–	8 488	13	–	–
Saint Pierre and Miquelon	3	100	0	0	n.s.	11
United States of America	133 014	44	30 225	10	206 084	68
North America	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–
American Samoa	–	–	–	–	–	–
Australia	31 781	21	26 621	18	31 781	21
Cook Islands	–	–	–	–	–	–
Fiji	0	0	92	9	6	1
French Polynesia	–	–	7	5	–	–
Guam	–	–	–	–	–	–
Kiribati	–	–	–	–	n.s.	2
Marshall Islands	–	–	–	–	–	–
Micronesia (Federated States of)	–	–	–	–	–	–
Nauru	–	–	–	–	–	–
New Caledonia	–	–	–	–	–	–
New Zealand	5 003	61	3 607	44	6 938	84
Niue	–	–	–	–	–	–
Norfolk Island	–	–	–	–	–	–
Northern Mariana Islands	–	–	–	–	–	–
Palau	–	–	–	–	–	–
Papua New Guinea	63	n.s.	313	1	–	–
Pitcairn	–	–	–	–	–	–
Samoa	–	–	–	–	–	–
Solomon Islands	0	0	0	0	0	0
Tokelau	–	–	–	–	–	–
Tonga	7	74	–	–	2	22
Tuvalu	–	–	–	–	–	–
Vanuatu	–	–	–	–	–	–
Wallis and Futuna Islands	n.s.	2	0	0	n.s.	2
Oceania	–	–	–	–	–	–
Argentina	–	–	1 160	4	–	–
Bolivia (Plurinational State of)	38 611	68	10 680	19	10 400	18
Brazil	242 986	47	89 541	17	30 543	6
Chile	13 634	84	3 992	25	2	n.s.
Colombia	–	–	–	–	–	–
Ecuador	9 221	93	–	–	–	–
Falkland Islands (Malvinas)*	–	–	–	–	–	–
French Guiana	6 598	82	2 418	30	2 222	27
Guyana	12 222	80	–	–	5 525	36
Paraguay	–	–	–	–	–	–
Peru	18 821	28	–	–	61 427	90
Suriname	6 689	45	2 015	14	–	–
Uruguay	752	43	–	–	–	–
Venezuela (Bolivarian Republic of)	–	–	–	–	–	–
South America	–	–	–	–	–	–
World	–	–	–	–	–	–

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 7
Forest characteristics 2010

Country/area	Primary forest		Other naturally regenerated forest			Planted Forest		
	1 000 ha	% of forest area	1 000 ha	% of forest area	% of which introduced species	1 000 ha	% of forest area	% of which introduced species
Angola	0	0	58 352	100	–	128	n.s.	–
Botswana	0	0	11 351	100	–	0	0	–
Comoros	0	0	2	67	0	1	33	100
Djibouti	0	0	6	100	–	0	0	–
Eritrea	0	0	1 498	98	0	34	2	90
Ethiopia	0	0	11 785	96	–	511	4	–
Kenya	654	19	2 616	75	–	197	6	100
Lesotho	0	0	34	76	–	10	24	100
Madagascar	3 036	24	9 102	73	–	415	3	100
Malawi	934	29	1 938	60	–	365	11	100
Mauritius	0	0	20	58	–	15	42	–
Mayotte	1	5	12	87	–	1	7	80
Mozambique	0	0	38 960	100	0	62	n.s.	100
Namibia	0	0	7 290	100	–	n.s.	n.s.	–
Réunion	55	63	28	32	29	5	6	80
Seychelles	2	5	34	83	–	5	12	–
Somalia	0	0	6 744	100	–	3	n.s.	–
South Africa	947	10	6 531	71	0	1 763	19	100
Swaziland	0	0	423	75	–	140	25	–
Uganda	0	0	2 937	98	–	51	2	100
United Republic of Tanzania	0	0	33 188	99	–	240	1	–
Zambia	0	0	49 406	100	–	62	n.s.	–
Zimbabwe	801	5	14 715	94	0	108	1	100
Eastern and Southern Africa	–	–	–	–	–	–	–	–
Algeria	0	0	1 088	73	–	404	27	–
Egypt	0	0	0	0	–	70	100	83
Libyan Arab Jamahiriya	0	0	0	0	–	217	100	–
Mauritania	0	0	221	91	–	21	9	–
Morocco	0	0	4 510	88	–	621	12	33
Sudan	13 990	20	49 891	71	–	6 068	9	n.s.
Tunisia	0	0	316	31	–	690	69	30
Western Sahara	0	0	707	100	0	0	0	–
Northern Africa	–	–	–	–	–	–	–	–
Benin	0	0	4 542	100	–	19	n.s.	100
Burkina Faso	0	0	5 540	98	–	109	2	80
Burundi	40	23	63	37	–	69	40	100
Cameroon	–	–	–	–	–	–	–	–
Cape Verde	0	0	0	0	–	85	100	100
Central African Republic	2 370	10	20 233	90	–	2	n.s.	100
Chad	184	2	11 324	98	–	17	n.s.	94
Congo	7 436	33	14 900	66	–	75	n.s.	–
Côte d'Ivoire	625	6	9 441	91	–	337	3	–
Democratic Republic of the Congo	–	–	–	–	–	59	n.s.	–
Equatorial Guinea	0	0	1 626	100	0	n.s.	n.s.	0
Gabon	14 334	65	7 636	35	0	30	n.s.	–
Gambia	1	n.s.	478	100	–	1	n.s.	–
Ghana	395	8	4 285	87	–	260	5	–

TABLE 7 (continued)
Forest characteristics 2010

Country/area	Primary forest		Other naturally regenerated forest			Planted Forest		
	1 000 ha	% of forest area	1 000 ha	% of forest area	% of which introduced species	1 000 ha	% of forest area	% of which introduced species
Guinea	63	1	6 388	98	–	93	1	80
Guinea-Bissau	0	0	2 021	100	–	1	n.s.	–
Liberia	175	4	4 146	96	–	8	n.s.	100
Mali	0	0	11 960	96	0	530	4	90
Niger	220	18	836	69	17	148	12	–
Nigeria	0	0	8 659	96	0	382	4	44
Rwanda	7	2	55	13	–	373	86	–
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–	–	–
Sao Tome and Principe	11	41	16	59	–	0	0	–
Senegal	1 553	18	6 456	76	–	464	5	53
Sierra Leone	113	4	2 599	95	–	15	1	–
Togo	0	0	245	85	–	42	15	–
Western and Central Africa	–	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–	–
China	11 632	6	118 071	57	5	77 157	37	28
Democratic People's Republic of Korea	780	14	4 104	72	–	781	14	–
Japan	4 747	19	9 906	40	–	10 326	41	–
Mongolia	5 152	47	5 601	51	–	145	1	–
Republic of Korea	2 957	48	1 443	23	–	1 823	29	67
East Asia	–	–	–	–	–	–	–	–
Bangladesh	436	30	769	53	–	237	16	17
Bhutan	413	13	2 833	87	–	3	n.s.	–
Brunei Darussalam	263	69	114	30	–	3	1	18
Cambodia	322	3	9 703	96	–	69	1	–
India	15 701	23	42 522	62	–	10 211	15	13
Indonesia	47 236	50	43 647	46	–	3 549	4	–
Lao People's Democratic Republic	1 490	9	14 037	89	–	224	1	–
Malaysia	3 820	19	14 829	72	0	1 807	9	–
Maldives	–	–	–	–	–	–	–	–
Myanmar	3 192	10	27 593	87	–	988	3	–
Nepal	526	14	3 067	84	13	43	1	23
Pakistan	0	0	1 347	80	–	340	20	–
Philippines	861	11	6 452	84	–	352	5	99
Singapore	2	100	0	0	–	0	0	–
Sri Lanka	167	9	1 508	81	–	185	10	–
Thailand	6 726	35	8 261	44	–	3 986	21	–
Timor-Leste	0	0	699	94	–	43	6	–
Viet Nam	80	1	10 205	74	–	3 512	25	–
South and Southeast Asia	–	–	–	–	–	–	–	–
Afghanistan	–	–	–	–	–	–	–	–
Armenia	13	5	228	87	–	21	8	–
Azerbaijan	400	43	516	55	–	20	2	–
Bahrain	0	0	0	0	–	1	100	–
Cyprus	13	8	129	75	0	31	18	5
Georgia	500	18	2 059	75	0	184	7	0
Iran (Islamic Republic of)	200	2	10 031	91	–	844	8	–

TABLE 7 (continued)
Forest characteristics 2010

Country/area	Primary forest		Other naturally regenerated forest			Planted Forest		
	1 000 ha	% of forest area	1 000 ha	% of forest area	% of which introduced species	1 000 ha	% of forest area	% of which introduced species
Iraq	0	0	810	98	–	15	2	–
Israel	0	0	66	43	1	88	57	30
Jordan	0	0	51	52	–	47	48	–
Kazakhstan	0	0	2 408	73	–	901	27	–
Kuwait	0	0	0	0	–	6	100	–
Kyrgyzstan	269	28	628	66	–	57	6	–
Lebanon	0	0	126	92	0	11	8	74
Occupied Palestinian Territory	–	–	–	–	–	–	–	–
Oman	0	0	0	0	–	2	100	0
Qatar	0	–	0	–	–	0	–	–
Saudi Arabia	360	37	617	63	–	0	0	–
Syrian Arab Republic	0	0	198	40	0	294	60	17
Tajikistan	297	72	12	3	–	101	25	4
Turkey	973	9	6 943	61	–	3 418	30	2
Turkmenistan	104	3	4 023	97	–	0	0	–
United Arab Emirates	0	0	0	0	–	317	100	0
Uzbekistan	72	2	2 569	78	–	635	19	–
Yemen	0	0	549	100	–	0	0	–
Western and Central Asia	–	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–	–
Albania	85	11	598	77	0	94	12	8
Andorra	–	–	–	–	–	–	–	–
Austria	–	–	–	–	–	–	–	–
Belarus	400	5	6 373	74	0	1 857	22	n.s.
Belgium	0	0	282	42	8	396	58	75
Bosnia and Herzegovina	2	n.s.	1 184	54	–	999	46	–
Bulgaria	338	9	2 774	71	6	815	21	5
Croatia	7	n.s.	1 843	96	3	70	4	39
Czech Republic	9	n.s.	13	n.s.	–	2 635	99	–
Denmark	25	5	112	21	31	407	75	47
Estonia	964	43	1 085	49	0	168	8	1
Faroe Islands	–	–	–	–	–	–	–	–
Finland	0	0	16 252	73	0	5 904	27	n.s.
France	30	n.s.	14 291	90	4	1 633	10	36
Germany	0	0	5 793	52	–	5 283	48	8
Gibraltar	0	–	0	–	–	0	–	–
Greece	0	0	3 763	96	–	140	4	–
Guernsey	–	–	–	–	–	–	–	–
Holy See	0	–	0	–	–	0	–	–
Hungary	0	0	417	21	48	1 612	79	41
Iceland	0	0	3	10	0	27	90	78
Ireland	0	0	82	11	18	657	89	76
Isle of Man	–	–	–	–	–	–	–	–
Italy	93	1	8 435	92	3	621	7	15
Jersey	–	–	–	–	–	–	–	–
Latvia	15	n.s.	2 711	81	0	628	19	n.s.
Liechtenstein	2	22	5	74	–	n.s.	4	–

TABLE 7 (continued)
Forest characteristics 2010

Country/area	Primary forest		Other naturally regenerated forest			Planted Forest		
	1 000 ha	% of forest area	1 000 ha	% of forest area	% of which introduced species	1 000 ha	% of forest area	% of which introduced species
Lithuania	26	1	1 613	75	0	521	24	1
Luxembourg	0	0	59	68	–	28	33	–
Malta	0	0	0	0	–	n.s.	100	–
Monaco	0	–	0	–	–	0	–	–
Montenegro	–	–	–	–	–	–	–	–
Netherlands	0	0	0	0	–	365	100	25
Norway	223	2	8 367	83	0	1 475	15	18
Poland	54	1	394	4	–	8 889	95	n.s.
Portugal	24	1	2 583	75	6	849	25	99
Republic of Moldova	0	0	384	99	–	2	1	–
Romania	300	5	4 827	73	–	1 446	22	–
Russian Federation	256 482	32	535 618	66	0	16 991	2	0
San Marino	0	–	0	–	–	0	–	–
Serbia	1	n.s.	2 532	93	–	180	7	–
Slovakia	24	1	950	49	3	959	50	2
Slovenia	109	9	1 112	89	0	32	3	–
Spain	0	0	15 493	85	3	2 680	15	37
Svalbard and Jan Mayen Islands	0	–	0	–	–	0	–	–
Sweden	2 609	9	21 981	78	0	3 613	13	18
Switzerland	40	3	1 028	83	n.s.	172	14	2
The former Yugoslav Republic of Macedonia	0	0	893	89	–	105	11	–
Ukraine	59	1	4 800	49	–	4 846	50	–
United Kingdom	0	0	662	23	0	2 219	77	64
Europe	–	–	–	–	–	–	–	–
Anguilla	–	–	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	–	–	–
Bahamas	0	0	515	100	–	0	0	–
Barbados	0	0	8	99	–	n.s.	1	100
Bermuda	–	–	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–	–	–
Cuba	0	0	2 384	83	0	486	17	28
Dominica	27	60	18	40	–	n.s.	n.s.	–
Dominican Republic	–	–	–	–	–	–	–	–
Grenada	2	14	14	85	–	n.s.	1	–
Guadeloupe	15	23	45	70	–	4	7	98
Haiti	0	0	73	72	–	28	28	–
Jamaica	88	26	242	72	5	7	2	100
Martinique	0	0	46	95	0	2	5	100
Montserrat	0	0	3	100	0	0	0	–
Netherlands Antilles	–	–	–	–	–	–	–	–
Puerto Rico	0	0	552	100	–	0	0	–
Saint Kitts and Nevis	–	–	–	–	–	–	–	–
Saint Lucia	12	24	34	73	–	1	3	–
Saint Martin (French part)	–	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	0	0	27	100	–	n.s.	n.s.	–

TABLE 7 (continued)
Forest characteristics 2010

Country/area	Primary forest		Other naturally regenerated forest			Planted Forest		
	1 000 ha	% of forest area	1 000 ha	% of forest area	% of which introduced species	1 000 ha	% of forest area	% of which introduced species
Saint Barthélemy	0	–	0	–	–	0	–	–
Trinidad and Tobago	62	28	146	64	0	18	8	83
Turks and Caicos Islands	–	–	–	–	–	–	–	–
United States Virgin Islands	0	0	20	100	0	0	0	–
Caribbean	–	–	–	–	–	–	–	–
Belize	599	43	792	57	–	2	n.s.	–
Costa Rica	623	24	1 741	67	–	241	9	–
El Salvador	5	2	267	93	0	15	5	91
Guatemala	1 619	44	1 865	51	–	173	5	–
Honduras	457	9	4 735	91	–	0	0	–
Nicaragua	1 179	38	1 861	60	–	74	2	–
Panama	0	0	3 172	98	–	79	2	79
Central America	–	–	–	–	–	–	–	–
Canada	165 448	53	135 723	44	–	8 963	3	–
Greenland	0	0	0	0	–	n.s.	100	100
Mexico	34 310	53	27 289	42	–	3 203	5	–
Saint Pierre and Miquelon	0	0	3	100	0	0	0	–
United States of America	75 277	25	203 382	67	n.s.	25 363	8	2
North America	–	–	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–	–	–
American Samoa	–	–	–	–	–	–	–	–
Australia	5 039	3	142 359	95	0	1 903	1	53
Cook Islands	0	0	14	93	–	1	7	–
Fiji	449	44	388	38	0	177	17	100
French Polynesia	40	26	105	68	–	10	6	–
Guam	–	–	–	–	–	–	–	–
Kiribati	0	0	12	100	0	0	0	–
Marshall Islands	8	65	0	0	–	4	35	–
Micronesia (Federated States of)	48	75	2	2	–	14	22	–
Nauru	0	–	0	–	–	0	–	–
New Caledonia	431	51	398	47	–	10	1	94
New Zealand	2 144	26	4 313	52	–	1 812	22	100
Niue	6	30	13	68	0	n.s.	2	100
Norfolk Island	–	–	–	–	–	–	–	–
Northern Mariana Islands	8	27	0	0	–	22	73	–
Palau	–	–	–	–	–	–	–	–
Papua New Guinea	26 210	91	2 430	8	–	86	n.s.	–
Pitcairn	–	–	–	–	–	–	–	–
Samoa	n.s.	n.s.	139	81	–	32	19	–
Solomon Islands	1 105	50	1 081	49	0	27	1	66
Tokelau	0	–	0	–	–	0	–	–
Tonga	4	44	4	44	–	1	11	100
Tuvalu	–	–	–	–	–	–	–	–
Vanuatu	–	–	–	–	–	–	–	–
Wallis and Futuna Islands	–	–	–	–	–	1	9	–
Oceania	–	–	–	–	–	–	–	–

TABLE 7 (continued)
Forest characteristics 2010

Country/area	Primary forest		Other naturally regenerated forest			Planted Forest		
	1 000 ha	% of forest area	1 000 ha	% of forest area	% of which introduced species	1 000 ha	% of forest area	% of which introduced species
Argentina	1 738	6	26 268	89	0	1 394	5	98
Bolivia (Plurinational State of)	37 164	65	20 012	35	–	20	n.s.	100
Brazil	476 573	92	35 532	7	–	7 418	1	96
Chile	4 439	27	9 408	58	–	2 384	15	100
Colombia	8 543	14	51 551	85	–	405	1	–
Ecuador	4 805	49	4 893	50	–	167	2	100
Falkland Islands (Malvinas)*	0	–	0	–	–	0	–	–
French Guiana	7 690	95	391	5	0	1	n.s.	100
Guyana	6 790	45	8 415	55	–	0	0	–
Paraguay	1 850	11	15 684	89	0	48	n.s.	–
Peru	60 178	89	6 821	10	–	993	1	–
Suriname	14 001	95	744	5	0	13	n.s.	54
Uruguay	306	18	460	26	–	978	56	100
Venezuela (Bolivarian Republic of)	–	–	–	–	–	–	–	–
South America	–	–	–	–	–	–	–	–
World	–	–	–	–	–	–	–	–

Note: Due to the structure of the table on forest characteristics, a reported zero for primary forest may be due to lack of data rather than a complete lack of primary forest.

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 8
Trends in extent of primary forest 1990–2010

Country/area	Area of primary forest (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%
Angola	0	0	0	0	0	–	0	–	0	–
Botswana	0	0	0	0	0	–	0	–	0	–
Comoros	0	0	0	0	0	–	0	–	0	–
Djibouti	0	0	0	0	0	–	0	–	0	–
Eritrea	0	0	0	0	0	–	0	–	0	–
Ethiopia	0	0	0	0	0	–	0	–	0	–
Kenya	694	674	664	654	-2	-0.29	-2	-0.30	-2	-0.30
Lesotho	0	0	0	0	0	–	0	–	0	–
Madagascar	3 367	3 214	3 137	3 036	-15	-0.46	-15	-0.48	-20	-0.65
Malawi	1 727	1 330	1 132	934	-40	-2.58	-40	-3.17	-40	-3.77
Mauritius	0	0	0	0	0	–	0	–	0	–
Mayotte	1	1	1	1	0	0	0	0	0	0
Mozambique	0	0	0	0	0	–	0	–	0	–
Namibia	0	0	0	0	0	–	0	–	0	–
Réunion	55	55	55	55	0	0	0	0	0	0
Seychelles	2	2	2	2	0	0	0	0	0	0
Somalia	0	0	0	0	0	–	0	–	0	–
South Africa	947	947	947	947	0	0	0	0	0	0
Swaziland	0	0	0	0	0	–	0	–	0	–
Uganda	0	0	0	0	0	–	0	–	0	–
United Republic of Tanzania	0	0	0	0	0	–	0	–	0	–
Zambia	0	0	0	0	0	–	0	–	0	–
Zimbabwe	801	801	801	801	0	0	0	0	0	0
Eastern and Southern Africa	–	–	–	–	–	–	–	–	–	–
Algeria	0	0	0	0	0	–	0	–	0	–
Egypt	0	0	0	0	0	–	0	–	0	–
Libyan Arab Jamahiriya	0	0	0	0	0	–	0	–	0	–
Mauritania	0	0	0	0	0	–	0	–	0	–
Morocco	0	0	0	0	0	–	0	–	0	–
Sudan	15 276	14 098	14 044	13 990	-118	-0.80	-11	-0.08	-11	-0.08
Tunisia	0	0	0	0	0	–	0	–	0	–
Western Sahara	0	0	0	0	0	–	0	–	0	–
Northern Africa	–	–	–	–	–	–	–	–	–	–
Benin	0	0	0	0	0	–	0	–	0	–
Burkina Faso	0	0	0	0	0	–	0	–	0	–
Burundi	110	40	40	40	-7	-9.62	0	0	0	0
Cameroon	–	–	0	–	–	–	–	–	–	–
Cape Verde	0	0	0	0	0	–	0	–	0	–
Central African Republic	3 900	3 135	2 752	2 370	-77	-2.16	-77	-2.57	-76	-2.94
Chad	209	196	190	184	-1	-0.64	-1	-0.62	-1	-0.64
Congo	7 548	7 492	7 464	7 436	-6	-0.07	-6	-0.07	-6	-0.08
Côte d'Ivoire	625	625	625	625	0	0	0	0	0	0
Democratic Republic of the Congo	–	–	–	–	–	–	–	–	–	–
Equatorial Guinea	0	0	0	0	0	–	0	–	0	–
Gabon	20 934	17 634	15 984	14 334	-330	-1.70	-330	-1.95	-330	-2.16
Gambia	1	1	1	1	0	0	n.s.	-3.58	n.s.	-4.36
Ghana	395	395	395	395	0	0	0	0	0	0
Guinea	63	63	63	63	0	0	0	0	0	0
Guinea-Bissau	0	0	0	0	0	–	0	–	0	–
Liberia	175	175	175	175	0	0	0	0	0	0

TABLE 8 (continued)
Trends in extent of primary forest 1990–2010

Country/area	Area of primary forest (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%
Mali	0	0	0	0	0	–	0	–	0	–
Niger	220	220	220	220	0	0	0	0	0	0
Nigeria	1 556	736	326	n.s.	-82	-7.21	-82	-15.03	-65	–
Rwanda	7	7	7	7	0	0	0	0	0	0
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–	–	–	–	–
Sao Tome and Principe	11	11	11	11	0	0	0	0	0	0
Senegal	1 759	1 653	1 598	1 553	-11	-0.62	-11	-0.67	-9	-0.57
Sierra Leone	224	157	133	113	-7	-3.49	-5	-3.26	-4	-3.21
Togo	0	0	0	0	0	–	0	–	0	–
Western and Central Africa	–	–	–	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–	–	–	–
China	11 646	11 632	11 632	11 632	-1	-0.01	0	0	0	0
Democratic People's Republic of Korea	1 129	954	867	780	-18	-1.67	-17	-1.89	-17	-2.09
Japan	3 764	4 054	4 449	4 747	29	0.74	79	1.88	60	1.31
Mongolia	6 043	5 539	5 346	5 152	-50	-0.87	-39	-0.71	-39	-0.74
Republic of Korea	–	4 277	3 617	2 957	–	–	-132	-3.30	-132	-3.95
East Asia	–	–	–	–	–	–	–	–	–	–
Bangladesh	436	436	436	436	0	0	0	0	0	0
Bhutan	413	413	413	413	0	0	0	0	0	0
Brunei Darussalam	313	288	275	263	-3	-0.83	-3	-0.92	-2	-0.89
Cambodia	766	456	322	322	-31	-5.05	-27	-6.72	0	0
India	15 701	15 701	15 701	15 701	0	0	0	0	0	0
Indonesia	–	49 270	47 750	47 236	–	–	-304	-0.62	-103	-0.22
Lao People's Democratic Republic	1 490	1 490	1 490	1 490	0	0	0	0	0	0
Malaysia	3 820	3 820	3 820	3 820	0	0	0	0	0	0
Maldives	–	–	–	–	–	–	–	–	–	–
Myanmar	3 192	3 192	3 192	3 192	0	0	0	0	0	0
Nepal	391	548	526	526	16	3.43	-4	-0.82	0	0
Pakistan	0	0	0	0	0	–	0	–	0	–
Philippines	861	861	861	861	0	0	0	0	0	0
Singapore	2	2	2	2	0	0	0	0	0	0
Sri Lanka	257	197	167	167	-6	-2.62	-6	-3.25	0	0
Thailand	6 726	6 726	6 726	6 726	0	0	0	0	0	0
Timor-Leste	0	0	0	0	0	–	0	–	0	–
Viet Nam	384	187	85	80	-20	-6.94	-20	-14.59	-1	-1.21
South and Southeast Asia	–	–	–	–	–	–	–	–	–	–
Afghanistan	–	–	–	–	–	–	–	–	–	–
Armenia	17	15	14	13	n.s.	-1.24	n.s.	-1.37	n.s.	-1.47
Azerbaijan	400	400	400	400	0	0	0	0	0	0
Bahrain	0	0	0	0	0	–	0	–	0	–
Cyprus	13	13	13	13	0	0	0	0	0	0
Georgia	500	500	500	500	0	0	0	0	0	0
Iran (Islamic Republic of)	200	200	200	200	0	0	0	0	0	0
Iraq	0	0	0	0	0	–	0	–	0	–
Israel	0	0	0	0	0	–	0	–	0	–
Jordan	–	–	0	0	–	–	–	–	0	–
Kazakhstan	0	0	0	0	0	–	0	–	0	–
Kuwait	0	0	0	0	0	–	0	–	0	–
Kyrgyzstan	237	240	241	269	n.s.	0.10	n.s.	0.11	6	2.23

TABLE 8 (continued)
Trends in extent of primary forest 1990–2010

Country/area	Area of primary forest (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%
Lebanon	–	–	0	0	–	–	–	–	0	–
Occupied Palestinian Territory	–	–	–	–	–	–	–	–	–	–
Oman	0	0	0	0	0	–	0	–	0	–
Qatar	0	0	0	0	0	–	0	–	0	–
Saudi Arabia	360	360	360	360	0	0	0	0	0	0
Syrian Arab Republic	0	0	0	0	0	–	0	–	0	–
Tajikistan	297	297	297	297	0	0	0	0	0	0
Turkey	739	897	922	973	16	1.96	5	0.55	10	1.08
Turkmenistan	104	104	104	104	0	0	0	0	0	0
United Arab Emirates	0	0	0	0	0	–	0	–	0	–
Uzbekistan	57	57	57	72	0	0	0	0	3	4.78
Yemen	0	0	0	0	0	–	0	–	0	–
Western and Central Asia	–	–	–	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–	–	–	–
Albania	85	85	85	85	0	0	0	0	0	0
Andorra	–	–	–	–	–	–	–	–	–	–
Austria	–	–	–	–	–	–	–	–	–	–
Belarus	400	400	400	400	0	0	0	0	0	0
Belgium	0	0	0	0	0	–	0	–	0	–
Bosnia and Herzegovina	2	2	2	2	0	0	0	0	0	0
Bulgaria	157	270	304	338	11	5.57	7	2.40	7	2.14
Croatia	7	7	7	7	0	0	0	0	0	0
Czech Republic	9	9	9	9	0	0	0	0	0	0
Denmark	21	23	25	25	n.s.	0.91	n.s.	1.68	0	0
Estonia	–	976	980	964	–	–	1	0.08	-3	-0.33
Faroe Islands	–	–	–	–	–	–	–	–	–	–
Finland	0	0	0	0	0	–	0	–	0	–
France	30	30	30	30	0	0	0	0	0	0
Germany	0	0	0	0	0	–	0	–	0	–
Gibraltar	0	0	0	0	0	–	0	–	0	–
Greece	0	0	0	0	0	–	0	–	0	–
Guernsey	–	–	–	–	–	–	–	–	–	–
Holy See	0	0	0	0	0	–	0	–	0	–
Hungary	0	0	0	0	0	–	0	–	0	–
Iceland	0	0	0	0	0	–	0	–	0	–
Ireland	0	0	0	0	0	–	0	–	0	–
Isle of Man	–	–	–	–	–	–	–	–	–	–
Italy	93	93	93	93	0	0	0	0	0	0
Jersey	–	–	–	–	–	–	–	–	–	–
Latvia	17	17	16	15	0	0	n.s.	-1.21	n.s.	-1.28
Liechtenstein	2	2	2	2	0	0	0	0	0	0
Lithuania	20	21	26	26	n.s.	0.49	1	4.36	0	0
Luxembourg	0	0	0	0	0	–	0	–	0	–
Malta	0	0	0	0	0	–	0	–	0	–
Monaco	0	0	0	0	0	–	0	–	0	–
Montenegro	–	–	–	–	–	–	–	–	–	–
Netherlands	0	0	0	0	0	–	0	–	0	–
Norway	223	223	223	223	0	0	0	0	0	0
Poland	30	51	54	54	2	5.45	1	1.15	0	0
Portugal	–	24	24	24	–	–	0	0	0	0
Republic of Moldova	0	0	0	0	0	–	0	–	0	–

TABLE 8 (continued)
Trends in extent of primary forest 1990–2010

Country/area	Area of primary forest (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%
Romania	300	300	300	300	0	0	0	0	0	0
Russian Federation [a]	241 726	258 131	255 470	256 482	1 641	0.66	-532	-0.21	202	0.08
San Marino	0	0	0	0	0	–	0	–	0	–
Serbia	1	1	1	1	0	0	0	0	0	0
Slovakia	24	24	24	24	0	0	0	0	0	0
Slovenia	63	95	111	109	3	4.19	3	3.16	n.s.	-0.36
Spain	0	0	0	0	0	–	0	–	0	–
Svalbard and Jan Mayen Islands	0	0	0	0	0	–	0	–	0	–
Sweden	2 609	2 609	2 609	2 609	0	0	0	0	0	0
Switzerland	40	40	40	40	0	0	0	0	0	0
The former Yugoslav Republic of Macedonia	0	0	0	0	0	–	0	–	0	–
Ukraine	59	59	59	59	0	0	0	0	0	0
United Kingdom	0	0	0	0	0	–	0	–	0	–
Europe	–	–	–	–	–	–	–	–	–	–
Anguilla	–	–	–	–	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	–	–	–	–	–
Bahamas	0	0	0	0	0	–	0	–	0	–
Barbados	0	0	0	0	0	–	0	–	0	–
Bermuda	–	–	–	–	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–	–	–	–	–
Cuba	0	0	0	0	0	–	0	–	0	–
Dominica	28	28	27	27	n.s.	-0.30	n.s.	-0.31	n.s.	-0.31
Dominican Republic	–	–	–	–	–	–	–	–	–	–
Grenada	2	2	2	2	0	0	0	0	0	0
Guadeloupe	15	15	15	15	0	0	0	0	0	0
Haiti	0	0	0	0	0	–	0	–	0	–
Jamaica	89	88	88	88	n.s.	-0.07	n.s.	-0.07	n.s.	-0.07
Martinique	0	0	0	0	0	–	0	–	0	–
Montserrat	0	0	0	0	0	–	0	–	0	–
Netherlands Antilles	–	–	–	–	–	–	–	–	–	–
Puerto Rico	0	0	0	0	0	–	0	–	0	–
Saint Kitts and Nevis	–	–	–	–	–	–	–	–	–	–
Saint Lucia	10	10	10	12	0	0	0	0	n.s.	2.03
Saint Martin (French part)	–	–	–	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	0	0	0	–	–	0	–	0	–
Saint Barthélemy	0	0	0	0	0	–	0	–	0	–
Trinidad and Tobago	62	62	62	62	0	0	0	0	0	0
Turks and Caicos Islands	–	–	–	–	–	–	–	–	–	–
United States Virgin Islands	0	0	0	0	0	–	0	–	0	–
Caribbean	–	–	–	–	–	–	–	–	–	–
Belize	599	599	599	599	0	0	0	0	0	0
Costa Rica	623	623	623	623	0	0	0	0	0	0
El Salvador	5	5	5	5	0	0	0	0	0	0
Guatemala	2 359	2 091	1 957	1 619	-27	-1.20	-27	-1.32	-68	-3.72
Honduras	–	–	457	457	–	–	–	–	0	0
Nicaragua	–	–	1 315	1 179	–	–	–	–	-27	-2.16
Panama	0	0	0	0	0	–	0	–	0	–
Central America	–	–	–	–	–	–	–	–	–	–

TABLE 8 (continued)
Trends in extent of primary forest 1990–2010

Country/area	Area of primary forest (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%
Canada	165 448	165 448	165 448	165 448	0	0	0	0	0	0
Greenland	0	0	0	0	0	–	0	–	0	–
Mexico	39 492	35 469	34 531	34 310	-402	-1.07	-188	-0.53	-44	-0.13
Saint Pierre and Miquelon	0	0	0	0	0	–	0	–	0	–
United States of America	69 980	72 878	74 075	75 277	290	0.41	239	0.33	240	0.32
North America	–	–	–	–	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–	–	–	–	–
American Samoa	–	–	–	–	–	–	–	–	–	–
Australia	–	–	5 233	5 039	–	–	–	–	-39	-0.75
Cook Islands	0	0	0	0	0	–	0	–	0	–
Fiji	490	445	448	449	-4	-0.94	1	0.14	n.s.	0.04
French Polynesia	–	–	40	40	–	–	–	–	0	0
Guam	–	–	–	–	–	–	–	–	–	–
Kiribati	0	0	0	0	0	–	0	–	0	–
Marshall Islands	8	8	8	8	0	0	0	0	0	0
Micronesia (Federated States of)	40	44	46	48	n.s.	1.06	n.s.	0.98	n.s.	0.93
Nauru	0	0	0	0	0	–	0	–	0	–
New Caledonia	431	431	431	431	0	0	0	0	0	0
New Zealand	–	–	2 144	2 144	–	–	–	–	0	0
Niue	–	–	–	6	–	–	–	–	–	–
Norfolk Island	–	–	–	–	–	–	–	–	–	–
Northern Mariana Islands	10	9	9	8	n.s.	-0.97	n.s.	-1.04	n.s.	-1.10
Palau	–	–	–	–	–	–	–	–	–	–
Papua New Guinea	31 329	29 534	28 344	26 210	-180	-0.59	-238	-0.82	-427	-1.55
Pitcairn	–	–	–	–	–	–	–	–	–	–
Samoa	–	n.s.	n.s.	n.s.	–	–	0	0	0	0
Solomon Islands	1 105	1 105	1 105	1 105	0	0	0	0	0	0
Tokelau	0	0	0	0	0	–	0	–	0	–
Tonga	4	4	4	4	0	0	0	0	0	0
Tuvalu	–	–	–	–	–	–	–	–	–	–
Vanuatu	–	–	–	–	–	–	–	–	–	–
Wallis and Futuna Islands	–	–	–	–	–	–	–	–	–	–
Oceania	–	–	–	–	–	–	–	–	–	–
Argentina	1 738	1 738	1 738	1 738	0	0.0	0	0.0	0	0.0
Bolivia (Plurinational State of)	40 804	39 046	38 164	37 164	-176	-0.44	-176	-0.46	-200	-0.53
Brazil	530 041	501 926	488 254	476 573	-2 812	-0.54	-2 734	-0.55	-2 336	-0.48
Chile	4 631	4 536	4 488	4 439	-10	-0.21	-10	-0.21	-10	-0.22
Colombia	8 828	8 685	8 614	8 543	-14	-0.16	-14	-0.16	-14	-0.17
Ecuador	–	4 682	4 743	4 805	–	–	12	0.26	12	0.26
Falkland Islands (Malvinas)*	0	0	0	0	0	–	0	–	0	–
French Guiana	8 006	7 816	7 738	7 690	-19	-0.24	-16	-0.20	-10	-0.12
Guyana	–	6 790	6 790	6 790	–	–	0	0	0	0
Paraguay	1 850	1 850	1 850	1 850	0	0.0	0	0	0	0
Peru	62 910	62 188	61 065	60 178	-72	-0.12	-225	-0.36	-177	-0.29
Suriname	14 208	14 137	14 093	14 001	-7	-0.05	-9	-0.06	-18	-0.13
Uruguay	288	297	302	306	1	0.31	1	0.33	1	0.26
Venezuela (Bolivarian Republic of)	–	–	–	–	–	–	–	–	–	–
South America	–	–	–	–	–	–	–	–	–	–
World	–	–	–	–	–	–	–	–	–	–

[a] The figures for the Russian Federation are affected by a change to the forest classification system in 1995.
* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 9
Trends in extent of planted forests 1990–2010

Country/area	Area of planted forest (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%
Angola	140	134	131	128	-1	-0.44	-1	-0.45	-1	-0.46
Botswana	0	0	0	0	0	–	0	–	0	–
Comoros	2	2	1	1	0	0	n.s.	-12.94	0	0
Djibouti	0	0	0	0	0	–	0	–	0	–
Eritrea	10	21	28	34	1	7.75	1	5.67	1	3.86
Ethiopia	491	491	491	511	0	0	0	0	4	0.80
Kenya	238	212	202	197	-3	-1.15	-2	-0.96	-1	-0.50
Lesotho	6	8	9	10	n.s.	3.17	n.s.	2.55	n.s.	2.26
Madagascar	231	272	290	415	4	1.65	4	1.29	25	7.43
Malawi	132	197	285	365	7	4.09	18	7.67	16	5.07
Mauritius	15	15	15	15	n.s.	-0.07	n.s.	-0.41	n.s.	0.27
Mayotte	n.s.	n.s.	1	1	n.s.	4.89	n.s.	11.06	n.s.	7.15
Mozambique	38	38	24	62	0	0.0	-3	-8.78	8	20.90
Namibia	0	0	n.s.	n.s.	0	–	n.s.	–	n.s.	34.76
Réunion	5	5	5	5	0	0	0	0	0	0
Seychelles	5	5	5	5	0	0	0	0	0	0
Somalia	3	3	3	3	0	0	0	0	0	0
South Africa	1 626	1 724	1 750	1 763	10	0.59	5	0.30	3	0.15
Swaziland	160	150	145	140	-1	-0.64	-1	-0.68	-1	-0.70
Uganda	34	32	31	51	n.s.	-0.60	n.s.	-0.63	4	10.47
United Republic of Tanzania	150	200	230	240	5	2.92	6	2.83	2	0.85
Zambia	60	60	60	62	0	0.0	0	0.0	n.s.	0.66
Zimbabwe	154	120	108	108	-3	-2.46	-2	-2.09	0	0
Eastern and Southern Africa	–	–	–	–	–	–	–	–	–	–
Algeria	333	345	370	404	1	0.35	5	1.41	7	1.77
Egypt	44	59	67	70	2	2.98	2	2.58	1	0.88
Libyan Arab Jamahiriya	217	217	217	217	0	0	0	0	0	0
Mauritania	5	13	17	21	1	10.03	1	5.51	1	4.32
Morocco	478	523	561	621	5	0.90	8	1.41	12	2.05
Sudan	5 424	5 639	5 854	6 068	22	0.39	43	0.75	43	0.72
Tunisia	293	519	606	690	23	5.88	17	3.15	17	2.63
Western Sahara	0	0	0	0	0	–	0	–	0	–
Northern Africa	–	–	–	–	–	–	–	–	–	–
Benin	10	13	15	19	n.s.	2.66	n.s.	2.90	1	4.84
Burkina Faso	7	58	78	109	5	24.23	4	6.26	6	6.84
Burundi	0	86	78	69	9	–	-2	-1.93	-2	-2.42
Cameroon	–	–	84	–	–	–	–	–	–	–
Cape Verde	58	82	84	85	2	3.58	n.s.	0.36	n.s.	0.36
Central African Republic	2	2	2	2	0	0	0	0	0	0
Chad	11	14	15	17	n.s.	2.44	n.s.	1.39	n.s.	2.53
Congo	51	51	51	75	0	0	0	0	5	8.02
Côte d'Ivoire	154	261	337	337	11	5.42	15	5.24	0	0
Democratic Republic of the Congo	56	57	57	59	n.s.	0.18	n.s.	0.18	n.s.	0.55
Equatorial Guinea	0	n.s.	n.s.	n.s.	n.s.	–	0	0	0	0
Gabon	30	30	30	30	0	0	0	0	0	0
Gambia	1	1	1	1	n.s.	0.74	0	0	0	0
Ghana	50	60	160	260	1	1.84	20	21.67	20	10.20
Guinea	60	72	82	93	1	1.84	2	2.64	2	2.55
Guinea-Bissau	n.s.	n.s.	1	1	n.s.	5.58	n.s.	7.85	n.s.	5.63
Liberia	8	8	8	8	0	0	0	0	0	0
Mali	5	55	205	530	5	27.10	30	30.10	65	20.92

TABLE 9 (continued)
Trends in extent of planted forests 1990–2010

Country/area	Area of planted forest (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%
Niger	48	73	110	148	3	4.28	7	8.55	8	6.11
Nigeria	251	316	349	382	7	2.33	7	2.01	7	1.82
Rwanda	248	282	323	373	3	1.29	8	2.75	10	2.92
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–	–	–	–	–
Sao Tome and Principe	0	0	0	0	0	–	0	–	0	–
Senegal	205	306	407	464	10	4.09	20	5.87	11	2.66
Sierra Leone	7	8	11	15	n.s.	1.66	1	7.23	1	5.30
Togo	24	34	38	42	1	3.54	1	2.25	1	2.02
Western and Central Africa	–	–	–	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–	–	–	–
China	41 950	54 394	67 219	77 157	1 244	2.63	2 565	4.33	1 988	2.80
Democratic People's Republic of Korea	1 130	955	868	781	-18	-1.67	-17	-1.89	-17	-2.09
Japan	10 287	10 331	10 324	10 326	4	0.04	-1	-0.01	n.s.	n.s.
Mongolia	25	76	116	145	5	11.76	8	8.83	6	4.56
Republic of Korea	–	1 738	1 781	1 823	–	–	9	0.49	8	0.47
East Asia	–	–	–	–	–	–	–	–	–	–
Bangladesh	239	271	278	237	3	1.26	1	0.51	-8	-3.14
Bhutan	1	2	2	3	n.s.	7.18	0	0	n.s.	8.45
Brunei Darussalam	1	1	2	3	n.s.	6.93	n.s.	8.42	n.s.	6.51
Cambodia	67	79	74	69	1	1.66	-1	-1.30	-1	-1.39
India	5 716	7 167	9 486	10 211	145	2.29	464	5.77	145	1.48
Indonesia	–	3 672	3 699	3 549	–	–	5	0.15	-30	-0.82
Lao People's Democratic Republic	3	99	224	224	10	41.86	25	17.74	0	0.0
Malaysia	1 956	1 659	1 573	1 807	-30	-1.63	-17	-1.06	47	2.81
Maldives	–	–	–	–	–	–	–	–	–	–
Myanmar	394	696	849	988	30	5.85	31	4.05	28	3.08
Nepal	40	42	43	43	n.s.	0.49	n.s.	0.47	0	0.0
Pakistan	234	296	318	340	6	2.38	4	1.44	4	1.35
Philippines	302	327	340	352	3	0.80	3	0.78	2	0.70
Singapore	0	0	0	0	0	–	0	–	0	–
Sri Lanka	242	221	195	185	-2	-0.90	-5	-2.47	-2	-1.05
Thailand	2 668	3 111	3 444	3 986	44	1.55	67	2.05	108	2.97
Timor-Leste	29	43	43	43	1	4.02	0	0	0	0
Viet Nam	967	2 050	2 794	3 512	108	7.80	149	6.39	144	4.68
South and Southeast Asia	–	–	–	–	–	–	–	–	–	–
Afghanistan	–	–	–	–	–	–	–	–	–	–
Armenia	14	11	10	21	n.s.	-2.38	n.s.	-1.89	2	16.00
Azerbaijan	20	20	20	20	0	0.0	0	0	0	0
Bahrain	n.s.	n.s.	n.s.	1	n.s.	5.56	n.s.	3.84	n.s.	3.26
Cyprus	24	28	29	31	n.s.	1.25	n.s.	1.33	n.s.	0.73
Georgia	54	60	61	184	1	1.06	n.s.	0.17	25	24.86
Iran (Islamic Republic of)	844	844	844	844	0	0.0	0	0	0	0
Iraq	15	15	15	15	0	0.0	0	0	0	0
Israel	66	88	88	88	2	2.92	0	0	0	0
Jordan	–	–	47	47	–	–	–	–	0	0
Kazakhstan	1 034	1 056	909	901	2	0.21	-29	-2.95	-2	-0.18
Kuwait	3	5	6	6	n.s.	3.46	n.s.	2.73	n.s.	2.40
Kyrgyzstan	46	59	66	57	1	2.68	1	2.23	-2	-3.05
Lebanon	–	–	10	11	–	–	–	–	n.s.	0.78

TABLE 9 (continued)
Trends in extent of planted forests 1990–2010

Country/area	Area of planted forest (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%
Occupied Palestinian Territory	–	–	–	–	–	–	–	–	–	–
Oman	2	2	2	2	0	0	0	0	0	0
Qatar	0	0	0	0	0	–	0	–	0	–
Saudi Arabia	0	0	0	0	0	–	0	–	0	–
Syrian Arab Republic	175	234	264	294	6	2.98	6	2.42	6	2.16
Tajikistan	99	101	101	101	n.s.	0.20	0	0	0	0
Turkey	1 778	2 344	2 620	3 418	57	2.80	55	2.25	160	5.46
Turkmenistan	0	0	0	0	0	–	0	–	0	–
United Arab Emirates	245	310	312	317	7	2.38	n.s.	0.13	1	0.34
Uzbekistan	203	464	594	635	26	8.62	26	5.06	8	1.34
Yemen	0	0	0	0	0	–	0	–	0	–
Western and Central Asia	–	–	–	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–	–	–	–
Albania	103	96	98	94	-1	-0.69	n.s.	0.37	-1	-0.87
Andorra	–	–	–	–	–	–	–	–	–	–
Austria	–	–	–	–	–	–	–	–	–	–
Belarus	1 518	1 692	1 757	1 857	17	1.09	13	0.76	20	1.11
Belgium	446	408	395	396	-4	-0.89	-3	-0.62	n.s.	0.01
Bosnia and Herzegovina	1 047	999	999	999	-5	-0.47	0	0.0	0	0.0
Bulgaria	1 032	933	874	815	-10	-1.00	-12	-1.30	-12	-1.39
Croatia	92	81	76	70	-1	-1.27	-1	-1.27	-1	-1.63
Czech Republic	2 610	2 616	2 626	2 635	1	0.02	2	0.08	2	0.07
Denmark	331	361	397	407	3	0.87	7	1.92	2	0.50
Estonia	–	170	170	168	–	–	0	0.0	n.s.	-0.24
Faroe Islands	–	–	–	–	–	–	–	–	–	–
Finland	4 393	4 956	5 904	5 904	56	1.21	190	3.56	0	0.0
France	1 539	1 593	1 608	1 633	5	0.35	3	0.19	5	0.31
Germany	5 121	5 283	5 283	5 283	16	0.31	0	0.0	0	0.0
Gibraltar	0	0	0	0	0	–	0	–	0	–
Greece	118	129	134	140	1	0.90	1	0.76	1	0.88
Guernsey	–	–	–	–	–	–	–	–	–	–
Holy See	0	0	0	0	0	–	0	–	0	–
Hungary	1 453	1 509	1 566	1 612	6	0.38	11	0.74	9	0.58
Iceland	6	15	22	27	1	10.45	1	7.78	1	3.73
Ireland	383	553	612	657	17	3.74	12	2.05	9	1.43
Isle of Man	–	–	–	–	–	–	–	–	–	–
Italy	547	584	602	621	4	0.66	4	0.61	4	0.62
Jersey	–	–	–	–	–	–	–	–	–	–
Latvia	724	709	691	628	–2	–0.21	–4	–0.51	–13	–1.89
Liechtenstein	n.s.	n.s.	n.s.	n.s.	n.s.	4.14	0	0.0	0	0.0
Lithuania	411	461	491	521	5	1.15	6	1.27	6	1.19
Luxembourg	28	28	28	28	0	0.0	0	0.0	0	0.0
Malta	n.s.	n.s.	n.s.	n.s.	0	0.0	0	0.0	0	0.0
Monaco	0	0	0	0	0	–	0	–	0	–
Montenegro	–	–	–	–	–	–	–	–	–	–
Netherlands	345	360	365	365	2	0.43	1	0.28	0	0.0
Norway	1 089	1 325	1 400	1 475	24	1.98	15	1.11	15	1.05
Poland	8 511	8 645	8 767	8 889	13	0.16	24	0.28	24	0.28
Portugal	–	776	812	849	–	–	7	0.91	7	0.90
Republic of Moldova	1	1	1	2	0	0.0	0	0.0	n.s.	14.87

TABLE 9 (continued)
Trends in extent of planted forests 1990–2010

Country/area	Area of planted forest (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%
Romania	1 402	1 401	1 406	1 446	n.s.	-0.01	1	0.07	8	0.56
Russian Federation	12 651	15 360	16 963	16 991	271	1.96	320	2.00	6	0.03
San Marino	0	0	0	0	0	–	0	–	0	–
Serbia	39	39	39	180	0	0	0	0	28	35.78
Slovakia	960	958	965	959	n.s.	-0.02	1	0.15	-1	-0.12
Slovenia	34	36	37	32	n.s.	0.57	n.s.	0.55	-1	-2.86
Spain	2 038	2 505	2 550	2 680	47	2.09	9	0.36	26	1.00
Svalbard and Jan Mayen Islands	0	0	0	0	0	–	0	–	0	–
Sweden	2 328	3 557	3 613	3 613	123	4.33	11	0.31	0	0.0
Switzerland	159	165	168	172	1	0.37	1	0.36	1	0.47
The former Yugoslav Republic of Macedonia	105	105	105	105	0	0	0	0	0	0
Ukraine	4 637	4 755	4 787	4 846	12	0.25	6	0.13	12	0.25
United Kingdom	1 965	2 145	2 189	2 219	18	0.88	9	0.41	6	0.27
Europe	–	–	–	–	–	–	–	–	–	–
Anguilla	–	–	–	–	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	–	–	–	–	–
Bahamas	0	0	0	0	0	–	0	–	0	–
Barbados	n.s.	n.s.	n.s.	n.s.	0	0	n.s.	7.03	n.s.	6.54
Bermuda	–	–	–	–	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–	–	–	–	–
Cuba	347	342	388	486	-1	-0.15	9	2.56	20	4.61
Dominica	0	n.s.	n.s.	n.s.	n.s.	–	0	0	0	0
Dominican Republic	–	–	–	–	–	–	–	–	–	–
Grenada	n.s.	n.s.	n.s.	n.s.	0	0	0	0	0	0
Guadeloupe	4	4	4	4	0	0	0	0	0	0
Haiti	12	20	24	28	1	5.24	1	3.71	1	3.13
Jamaica	9	8	8	7	n.s.	-0.82	0	0	n.s.	-2.30
Martinique	2	2	2	2	0	0	0	0	0	0
Montserrat	0	0	0	0	0	–	0	–	0	–
Netherlands Antilles	–	–	–	–	–	–	–	–	–	–
Puerto Rico	0	0	0	0	0	–	0	–	0	–
Saint Kitts and Nevis	–	–	–	–	–	–	–	–	–	–
Saint Lucia	1	1	1	1	0	0	0	0	0	0
Saint Martin (French part)	–	–	–	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	n.s.	n.s.	n.s.	–	–	0	0	0	0
Saint Barthélemy	0	0	0	0	0	–	0	–	0	–
Trinidad and Tobago	15	16	17	18	n.s.	0.65	n.s.	1.22	n.s.	1.15
Turks and Caicos Islands	–	–	–	–	–	–	–	–	–	–
United States Virgin Islands	0	0	0	0	0	–	0	–	0	–
Caribbean	–	–	–	–	–	–	–	–	–	–
Belize	2	2	2	2	n.s.	0.45	0	0	n.s.	0.85
Costa Rica	295	203	222	241	-9	-3.67	4	1.78	4	1.66
El Salvador	10	13	14	15	n.s.	2.36	n.s.	2.00	n.s.	1.68
Guatemala	51	93	101	173	4	6.19	2	1.66	14	11.36
Honduras	–	–	0	0	–	–	–	–	0	–
Nicaragua	–	–	74	74	–	–	–	–	0	0
Panama	13	44	62	79	3	13.31	4	7.12	3	5.03
Central America	–	–	–	–	–	–	–	–	–	–

TABLE 9 (continued)
Trends in extent of planted forests 1990–2010

Country/area	Area of planted forest (1 000 ha)				Annual change rate					
	1990	2000	2005	2010	1990–2000		2000–2005		2005–2010	
					1 000 ha/yr	%	1 000 ha/yr	%	1 000 ha/yr	%
Canada	1 357	5 820	8 048	8 963	446	15.67	446	6.70	183	2.18
Greenland	n.s.	n.s.	n.s.	n.s.	0	0	0	0	0	0
Mexico	0	1 058	2 394	3 203	106	–	267	17.74	162	6.00
Saint Pierre and Miquelon	0	0	0	0	0	–	0	–	0	–
United States of America	17 938	22 560	24 425	25 363	462	2.32	373	1.60	188	0.76
North America	–	–	–	–	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–	–	–	–	–
American Samoa	–	–	–	–	–	–	–	–	–	–
Australia	1 023	1 176	1 628	1 903	15	1.40	90	6.72	55	3.17
Cook Islands	1	1	1	1	n.s.	8.20	0	0	0	0
Fiji	92	130	153	177	4	3.53	5	3.31	5	2.84
French Polynesia	–	9	9	10	–	–	0	0	n.s.	2.13
Guam	–	–	–	–	–	–	–	–	–	–
Kiribati	0	0	0	0	0	–	0	–	0	–
Marshall Islands	4	4	4	4	0	0	0	0	0	0
Micronesia (Federated States of)	20	17	16	14	n.s.	-1.60	n.s.	-1.82	n.s.	-2.00
Nauru	0	0	0	0	0	–	0	–	0	–
New Caledonia	9	10	10	10	n.s.	0.85	n.s.	0.52	n.s.	0.57
New Zealand	1 261	1 809	1 854	1 812	55	3.67	9	0.49	-8	-0.46
Niue	–	–	–	n.s.	–	–	–	–	–	–
Norfolk Island	–	–	–	–	–	–	–	–	–	–
Northern Mariana Islands	24	23	22	22	n.s.	-0.31	n.s.	-0.31	n.s.	-0.32
Palau	–	–	–	–	–	–	–	–	–	–
Papua New Guinea	63	82	92	86	2	2.75	2	2.30	-1	-1.38
Pitcairn	–	–	–	–	–	–	–	–	–	–
Samoa	–	32	32	32	–	–	0	0	0	0
Solomon Islands	44	28	27	27	-2	-4.64	n.s.	-0.51	0	0
Tokelau	0	0	0	0	0	–	0	–	0	–
Tonga	1	1	1	1	0	0	0	0	0	0
Tuvalu	–	–	–	–	–	–	–	–	–	–
Vanuatu	–	–	–	–	–	–	–	–	–	–
Wallis and Futuna Islands	n.s.	n.s.	n.s.	1	n.s.	6.35	n.s.	3.99	n.s.	3.33
Oceania	–	–	–	–	–	–	–	–	–	–
Argentina	766	1 076	1 203	1 394	31	3.46	25	2.26	38	2.99
Bolivia (Plurinational State of)	20	20	20	20	0	0	0	0	0	0
Brazil	4 984	5 176	5 765	7 418	19	0.38	118	2.18	331	5.17
Chile	1 707	1 936	2 063	2 384	23	1.27	25	1.28	64	2.93
Colombia	137	255	330	405	12	6.41	15	5.29	15	4.18
Ecuador	–	161	165	167	–	–	1	0.49	n.s.	0.24
Falkland Islands (Malvinas)*	0	0	0	0	0	–	0	–	0	–
French Guiana	1	1	1	1	0	0	0	0	0	0
Guyana	–	0	0	0	–	–	0	–	0	–
Paraguay	23	36	43	48	1	4.58	1	3.62	1	2.22
Peru	263	715	754	993	45	10.52	8	1.07	48	5.66
Suriname	13	13	13	13	0	0	0	0	0	0
Uruguay	201	669	766	978	47	12.78	19	2.74	42	5.01
Venezuela (Bolivarian Republic of)	–	–	–	–	–	–	–	–	–	–
South America	–	–	–	–	–	–	–	–	–	–
World	–	–	–	–	–	–	–	–	–	–

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 10
Growing stock in forest and other wooded land 2010

Country/area	Growing stock[a] in forest					Growing stock[a] on other wooded land	
	Total (million m³)	Per hectare (m³)	Coniferous (million m³)	Broadleaved (million m³)	% commercial species	Total (million m³)	Per hectare (m³)
Angola	2 266	39	–	–	12	–	–
Botswana	760	67	0	760	–	–	–
Comoros	1	213	1	0	100	–	–
Djibouti	n.s.	32	–	–	–	–	–
Eritrea	–	–	–	–	–	–	–
Ethiopia	264	21	–	–	25	103	2
Kenya	629	181	60	569	9	458	16
Lesotho	3	65	–	–	–	1	10
Madagascar	2 146	171	–	–	28	706	45
Malawi	354	109	–	–	–	–	–
Mauritius	3	85	1	2	62	n.s.	28
Mayotte	–	–	–	–	–	–	–
Mozambique	1 420	36	–	–	14	287	20
Namibia	175	24	–	–	–	43	5
Réunion	17	195	n.s.	17	3	1	20
Seychelles	3	74	–	–	–	–	–
Somalia	169	25	–	–	–	–	–
South Africa	670	73	–	–	36	491	20
Swaziland	19	34	–	–	56	5	12
Uganda	131	44	4	127	3	24	7
United Republic of Tanzania	1 237	37	–	–	–	116	10
Zambia	2 755	56	–	–	12	58	10
Zimbabwe	596	38	7	589	2	–	–
Eastern and Southern Africa	–	–	–	–	–	–	–
Algeria	114	76	76	38	100	10	4
Egypt	8	120	n.s.	8	0	n.s.	11
Libyan Arab Jamahiriya	8	36	–	–	0	4	13
Mauritania	5	20	0	5	–	31	10
Morocco	187	36	56	131	71	1	2
Sudan	972	14	–	–	–	402	8
Tunisia	26	26	12	14	2	1	4
Western Sahara	26	37	0	26	–	0	–
Northern Africa	–	–	–	–	–	–	–
Benin	161	35	0	161	67	–	–
Burkina Faso	237	42	–	–	–	75	15
Burundi	20	117	–	–	–	–	–
Cameroon	6 141	308	0	6 141	18	244	19
Cape Verde	12	145	–	–	100	–	–
Central African Republic	3 776	167	0	3 776	28	–	–
Chad	211	18	–	–	38	65	7
Congo	4 539	203	–	–	30	479	46
Côte d'Ivoire	2 632	253	–	–	–	–	–
Democratic Republic of the Congo	35 473	230	–	–	–	–	–
Equatorial Guinea	268	165	0	268	–	–	–
Gabon	4 895	223	0	4 895	8	–	–
Gambia	18	37	–	–	–	2	20
Ghana	291	59	–	–	–	–	–
Guinea	506	77	–	–	–	–	–

TABLE 10 (continued)
Growing stock in forest and other wooded land 2010

Country/area	Growing stock[a] in forest					Growing stock[a] on other wooded land	
	Total (million m³)	Per hectare (m³)	Coniferous (million m³)	Broadleaved (million m³)	% commercial species	Total (million m³)	Per hectare (m³)
Guinea-Bissau	61	30	–	–	34	1	3
Liberia	684	158	–	–	–	–	–
Mali	246	20	0	246	30	62	8
Niger	12	10	–	–	100	11	3
Nigeria	1 161	128	0	1 161	14	–	–
Rwanda	79	182	–	–	95	2	30
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–	–
Sao Tome and Principe	5	167	–	–	100	–	–
Senegal	316	37	0	316	75	23	5
Sierra Leone	109	40	–	–	25	3	15
Togo	–	–	–	–	–	–	–
Western and Central Africa	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–
China	14 684	71	6 901	7 782	31	1 112	11
Democratic People's Republic of Korea	360	64	–	–	–	0	–
Japan	–	–	–	–	–	–	–
Mongolia	1 426	131	1 336	90	–	2	1
Republic of Korea	605	97	324	281	66	0	–
East Asia	–	–	–	–	–	–	–
Bangladesh	70	48	0	70	62	–	–
Bhutan	650	200	406	244	40	–	–
Brunei Darussalam	72	190	0	72	84	1	26
Cambodia	959	95	–	–	–	–	–
India	5 489	80	550	4 940	26	–	–
Indonesia	11 343	120	–	–	–	–	–
Lao People's Democratic Republic	929	59	–	–	–	34	7
Malaysia	4 239	207	–	–	–	–	–
Maldives	–	–	–	–	–	0	–
Myanmar	1 430	45	–	–	28	–	–
Nepal	647	178	–	–	–	67	35
Pakistan	160	95	138	22	–	–	–
Philippines	1 278	167	42	1 237	–	223	22
Singapore	–	–	–	–	–	0	–
Sri Lanka	39	21	–	–	–	–	–
Thailand	783	41	–	–	–	–	–
Timor-Leste	–	–	–	–	–	0	–
Viet Nam	870	63	22	848	32	–	–
South and Southeast Asia	–	–	–	–	–	–	–
Afghanistan	21	16	–	–	–	–	–
Armenia	33	126	–	–	–	1	18
Azerbaijan	127	136	–	–	–	–	–
Bahrain	–	–	–	–	–	–	–
Cyprus	9	51	9	n.s.	89	–	–
Georgia	467	170	126	341	–	–	–
Iran (Islamic Republic of)	536	48	–	–	–	–	–
Iraq	–	–	–	–	–	–	–

TABLE 10 (continued)
Growing stock in forest and other wooded land 2010

Country/area	Growing stock[a] in forest					Growing stock[a] on other wooded land	
	Total (million m³)	Per hectare (m³)	Coniferous (million m³)	Broadleaved (million m³)	% commercial species	Total (million m³)	Per hectare (m³)
Israel	6	38	3	3	3	–	–
Jordan	3	30	–	–	0	–	–
Kazakhstan	364	110	239	125	0	12	1
Kuwait	–	–	–	–	–	0	–
Kyrgyzstan	45	47	32	13	0	–	–
Lebanon	5	37	4	1	29	1	5
Occupied Palestinian Territory	–	–	–	–	–	0	–
Oman	–	–	–	–	–	–	–
Qatar	0	–	0	0	–	–	–
Saudi Arabia	8	8	3	5	0	6	5
Syrian Arab Republic	–	–	–	–	–	–	–
Tajikistan	5	13	–	–	0	1	4
Turkey	1 526	135	1 001	524	71	91	9
Turkmenistan	15	4	–	–	0	–	–
United Arab Emirates	16	49	–	–	0	n.s.	25
Uzbekistan	26	8	7	19	n.s.	–	–
Yemen	5	9	–	–	0	12	8
Western and Central Asia	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–
Albania	75	97	19	57	100	7	29
Andorra	–	–	–	–	–	–	–
Austria	1 135	292	905	230	100	–	–
Belarus	1 580	183	1 061	519	100	–	–
Belgium	168	248	87	81	100	–	–
Bosnia and Herzegovina	358	164	135	223	100	–	–
Bulgaria	656	167	287	369	100	–	–
Croatia	410	213	51	359	100	6	10
Czech Republic	769	290	634	136	100	0	–
Denmark	108	199	51	58	100	1	23
Estonia	449	203	253	197	100	6	44
Faroe Islands	–	–	–	–	–	–	–
Finland	2 189	99	1 756	433	98	10	9
France	2 584	162	937	1 647	100	–	–
Germany	3 492	315	–	–	–	–	–
Gibraltar	0	–	0	0	–	0	–
Greece	185	47	79	106	–	–	–
Guernsey	–	–	–	–	–	0	–
Holy See	0	–	0	0	–	0	–
Hungary	359	177	55	305	94	0	–
Iceland	n.s.	15	n.s.	n.s.	–	1	9
Ireland	74	101	63	12	98	–	–
Isle of Man	–	–	–	–	–	0	–
Italy	1 384	151	504	880	100	64	36
Jersey	–	–	–	–	–	0	–
Latvia	633	189	335	298	100	2	17
Liechtenstein	2	254	–	–	–	–	–
Lithuania	470	218	274	196	100	2	30
Luxembourg	26	299	8	18	100	–	–

TABLE 10 (continued)
Growing stock in forest and other wooded land 2010

Country/area	Growing stock[a] in forest					Growing stock[a] on other wooded land	
	Total (million m³)	Per hectare (m³)	Coniferous (million m³)	Broadleaved (million m³)	% commercial species	Total (million m³)	Per hectare (m³)
Malta	n.s.	231	–	–	–	0	–
Monaco	0	–	0	0	–	0	–
Montenegro	72	133	30	43	–	–	–
Netherlands	70	192	36	34	100	0	–
Norway	987	98	753	234	100	25	9
Poland	2 049	219	1 599	450	100	0	–
Portugal	186	54	91	95	83	2	12
Republic of Moldova	48	123	1	47	–	4	51
Romania	1 390	212	417	973	100	–	–
Russian Federation	81 523	101	61 570	19 952	100	1 775	24
San Marino	0	–	0	0	–	0	–
Serbia	415	153	50	365	84	–	–
Slovakia	514	266	234	280	100	–	–
Slovenia	416	332	187	228	100	1	62
Spain	912	50	523	390	96	2	n.s.
Svalbard and Jan Mayen Islands	0	–	0	0	–	0	–
Sweden	3 358	119	2 740	618	100	11	4
Switzerland	428	345	290	139	100	–	–
The former Yugoslav Republic of Macedonia	76	77	8	69	100	–	–
Ukraine	2 119	218	1 122	997	100	–	–
United Kingdom	379	132	281	98	100	1	50
Europe	–	–	–	–	–	–	–
Anguilla	–	–	–	–	–	0	–
Antigua and Barbuda	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	0	–
Bahamas	–	–	–	–	–	–	–
Barbados	–	–	–	–	–	–	–
Bermuda	–	–	–	–	–	0	–
British Virgin Islands	–	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	0	–
Cuba	258	90	32	227	100	–	–
Dominica	–	–	–	–	–	–	–
Dominican Republic	122	62	–	–	–	–	–
Grenada	1	45	–	–	–	–	–
Guadeloupe	26	409	n.s.	26	3	n.s.	8
Haiti	7	65	2	5	–	–	–
Jamaica	52	154	n.s.	51	2	24	129
Martinique	15	311	0	15	3	–	–
Montserrat	–	–	–	–	–	–	–
Netherlands Antilles	–	–	–	–	–	–	–
Puerto Rico	19	35	0	19	–	–	–
Saint Kitts and Nevis	–	–	–	–	–	–	–
Saint Lucia	–	–	–	–	–	0	–
Saint Martin (French part)	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	–	–	–	–	0	–
Saint Barthélemy	0	–	0	0	–	–	–
Trinidad and Tobago	24	105	1	23	87	2	19

TABLE 10 (continued)
Growing stock in forest and other wooded land 2010

Country/area	Growing stock[a] in forest					Growing stock[a] on other wooded land	
	Total (million m³)	Per hectare (m³)	Coniferous (million m³)	Broadleaved (million m³)	% commercial species	Total (million m³)	Per hectare (m³)
Turks and Caicos Islands	–	–	–	–	–	0	–
United States Virgin Islands	n.s.	16	0	n.s.	–	–	–
Caribbean	–	–	–	–	–	–	–
Belize	226	162	–	–	–	–	–
Costa Rica	272	104	–	–	–	–	–
El Salvador	–	–	–	–	–	–	–
Guatemala	596	163	–	–	17	53	32
Honduras	629	121	174	456	–	–	–
Nicaragua	461	148	14	447	17	–	–
Panama	664	204	4	660	–	13	16
Central America	–	–	–	–	–	–	–
Canada	32 983	106	25 336	7 647	–	–	–
Greenland	–	–	–	–	–	–	–
Mexico	2 870	44	997	1 873	–	36	2
Saint Pierre and Miquelon	–	–	–	–	–	0	–
United States of America	47 088	155	34 282	12 805	92	–	–
North America	–	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–	–
American Samoa	2	104	0	2	–	0	–
Australia	–	–	–	–	–	–	–
Cook Islands	–	–	–	–	–	0	–
Fiji	–	–	–	–	–	–	–
French Polynesia	–	–	–	–	–	–	–
Guam	2	64	0	2	–	0	–
Kiribati	–	–	–	–	–	0	–
Marshall Islands	2	162	0	2	–	0	–
Micronesia (Federated States of)	17	272	0	17	–	0	–
Nauru	0	–	0	0	–	0	–
New Caledonia	53	64	–	–	–	–	–
New Zealand	3 586	434	968	2 618	14	258	101
Niue	–	–	–	–	–	0	–
Norfolk Island	–	–	–	–	–	0	–
Northern Mariana Islands	1	48	0	1	–	0	–
Palau	8	190	0	8	–	0	–
Papua New Guinea	2 726	95	0	2 726	–	70	16
Pitcairn	–	–	–	–	–	–	–
Samoa	–	–	–	–	–	–	–
Solomon Islands	208	94	–	–	51	–	–
Tokelau	0	–	0	0	–	0	–
Tonga	1	156	–	–	43	0	–
Tuvalu	–	–	–	–	–	0	–
Vanuatu	–	–	–	–	–	–	–
Wallis and Futuna Islands	–	–	–	–	–	–	–
Oceania	–	–	–	–	–	–	–
Argentina	2 931	100	504	2 427	69	858	14
Bolivia (Plurinational State of)	4 242	74	0	4 242	–	–	–
Brazil	126 221	243	345	125 876	35	–	–

TABLE 10 (continued)
Growing stock in forest and other wooded land 2010

Country/area	Growing stock[a] in forest					Growing stock[a] on other wooded land	
	Total (million m³)	Per hectare (m³)	Coniferous (million m³)	Broadleaved (million m³)	% commercial species	Total (million m³)	Per hectare (m³)
Chile	2 997	185	334	2 663	63	–	–
Colombia	8 982	148	–	–	–	–	–
Ecuador	–	–	–	–	–	–	–
Falkland Islands (Malvinas)*	0	–	0	0	–	0	–
French Guiana	2 829	350	0	2 829	–	0	–
Guyana	2 206	145	0	2 206	–	–	–
Paraguay	–	–	–	–	–	–	–
Peru	8 159	120	–	–	–	–	–
Suriname	3 389	230	0	3 389	–	–	–
Uruguay	125	72	1	124	8	–	–
Venezuela (Bolivarian Republic of)	–	–	–	–	–	–	–
South America	**–**	**–**	**–**	**–**	**–**	**–**	**–**
World	**–**	**–**	**–**	**–**	**–**	**–**	**–**

[a] Growing stock refers to volume over bark of all living trees.
* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 11
Trends in carbon stock in living forest biomass 1990–2010

Country/area	Carbon stock in living forest biomass (million tonnes)					Annual change (1 000 t/yr)			Annual change per hectare (t/ha/yr)		
	1990	2000	2005	2010	Per hectare 2010 (tonnes)	1990–2000	2000–2005	2005–2010	1990–2000	2000–2005	2005–2010
Angola	4 573	4 479	4 432	4 385	75	-9	-9	-9	n.s.	n.s.	n.s.
Botswana	680	663	655	646	57	-2	-2	-2	n.s.	n.s.	n.s.
Comoros	2	1	1	n.s.	117	n.s.	n.s.	n.s.	0.7	n.s.	-5.5
Djibouti	n.s.	n.s.	n.s.	n.s.	41	0	0	0	0	0	0
Eritrea	–	–	–	–	–	–	–	–	–	–	–
Ethiopia	289	254	236	219	18	-4	-4	-3	n.s.	n.s.	n.s.
Kenya	525	503	489	476	137	-2	-3	-3	n.s.	n.s.	n.s.
Lesotho	2	2	2	2	53	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Madagascar	1 778	1 691	1 663	1 626	130	-9	-6	-7	n.s.	n.s.	n.s.
Malawi	173	159	151	144	44	-1	-2	-1	n.s.	n.s.	n.s.
Mauritius	3	3	2	2	65	n.s.	n.s.	0	n.s.	n.s.	n.s.
Mayotte	–	–	–	–	–	–	–	–	–	–	–
Mozambique	1 878	1 782	1 733	1 692	43	-10	-10	-8	n.s.	n.s.	n.s.
Namibia	253	232	221	210	29	-2	-2	-2	n.s.	n.s.	n.s.
Réunion	6	6	6	6	68	0	n.s.	n.s.	0	n.s.	n.s.
Seychelles	4	4	4	4	88	0	0	0	0	0	0
Somalia	482	439	415	394	58	-4	-5	-4	n.s.	n.s.	n.s.
South Africa	807	807	807	807	87	0	0	0	0	0	0
Swaziland	23	22	22	22	39	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Uganda	171	140	124	109	36	-3	-3	-3	n.s.	n.s.	n.s.
United Republic of Tanzania	2 505	2 262	2 139	2 019	60	-24	-25	-24	n.s.	n.s.	n.s.
Zambia	2 579	2 497	2 457	2 416	49	-8	-8	-8	n.s.	n.s.	n.s.
Zimbabwe	697	594	543	492	31	-10	-10	-10	n.s.	n.s.	n.s.
Eastern and Southern Africa	–	–	–	–	–	–	–	–	–	–	–
Algeria	78	74	72	70	47	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Egypt	4	6	7	7	99	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Libyan Arab Jamahiriya	6	6	6	6	28	0	0	0	0	0	0
Mauritania	13	10	8	7	30	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Morocco	190	212	224	223	43	2	2	n.s.	n.s.	n.s.	n.s.
Sudan	1 521	1 403	1 398	1 393	20	-12	-1	-1	n.s.	n.s.	n.s.
Tunisia	6	8	8	9	9	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Western Sahara	33	33	33	33	46	0	0	0	0	0	0
Northern Africa	–	–	–	–	–	–	–	–	–	–	–
Benin	332	291	277	263	58	-4	-3	-3	n.s.	n.s.	n.s.
Burkina Faso	355	323	308	292	52	-3	-3	-3	n.s.	n.s.	n.s.
Burundi	25	19	18	17	96	-1	n.s.	n.s.	1.0	n.s.	n.s.
Cameroon	3 292	2 993	2 844	2 696	135	-30	-30	-30	n.s.	n.s.	n.s.
Cape Verde	3	5	5	5	58	n.s.	0	n.s.	n.s.	n.s.	n.s.
Central African Republic	2 936	2 898	2 879	2 861	127	-4	-4	-4	n.s.	n.s.	n.s.
Chad	722	677	655	635	55	-5	-4	-4	n.s.	n.s.	n.s.
Congo	3 487	3 461	3 448	3 438	153	-3	-3	-2	n.s.	n.s.	n.s.
Côte d'Ivoire	1 811	1 832	1 847	1 842	177	2	3	-1	n.s.	n.s.	n.s.
Democratic Republic of the Congo	20 433	20 036	19 838	19 639	127	-40	-40	-40	n.s.	n.s.	n.s.
Equatorial Guinea	232	217	210	203	125	-1	-1	-1	n.s.	n.s.	n.s.
Gabon	2 710	2 710	2 710	2 710	123	0	0	0	0	0	0
Gambia	29	30	31	32	66	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Ghana	564	465	423	381	77	-10	-8	-8	n.s.	n.s.	n.s.
Guinea	687	653	636	619	95	-3	-3	-3	n.s.	n.s.	n.s.
Guinea-Bissau	106	101	98	96	47	-1	-1	n.s.	n.s.	n.s.	n.s.
Liberia	666	625	605	585	135	-4	-4	-4	n.s.	n.s.	n.s.

TABLE 11 (continued)
Trends in carbon stock in living forest biomass 1990–2010

Country/area	Carbon stock in living forest biomass (million tonnes)					Annual change (1 000 t/yr)			Annual change per hectare (t/ha/yr)		
	1990	2000	2005	2010	Per hectare 2010 (tonnes)	1990–2000	2000–2005	2005–2010	1990–2000	2000–2005	2005–2010
Mali	317	300	291	282	23	-2	-2	-2	n.s.	n.s.	n.s.
Niger	60	41	38	37	31	-2	-1	n.s.	n.s.	n.s.	n.s.
Nigeria	2 016	1 550	1 317	1 085	120	-47	-47	-46	n.s.	n.s.	n.s.
Rwanda	35	18	35	39	91	-2	3	1	-6.0	7.7	n.s.
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–	–	–	–	–	–
Sao Tome and Principe	4	4	4	4	141	0	0	0	0	0	0
Senegal	377	357	348	340	40	-2	-2	-2	n.s.	n.s.	n.s.
Sierra Leone	247	232	224	216	79	-2	-2	-2	n.s.	n.s.	n.s.
Togo	–	–	–	–	–	–	–	–	–	–	–
Western and Central Africa	–	–	–	–	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–	–	–	–	–
China	4 414	5 295	5 802	6 203	30	88	101	80	n.s.	n.s.	n.s.
Democratic People's Republic of Korea	239	207	190	171	30	-3	-3	-4	n.s.	n.s.	n.s.
Japan	1 159	1 381	1 526	–	–	22	29	–	0.9	1.1	–
Mongolia	671	626	605	583	53	-5	-4	-4	n.s.	n.s.	n.s.
Republic of Korea	109	181	224	268	43	7	9	9	1.2	1.4	1.5
East Asia	–	–	–	–	–	–	–	–	–	–	–
Bangladesh	84	82	82	80	55	n.s.	0	n.s.	n.s.	n.s.	n.s.
Bhutan	296	313	324	336	103	2	2	2	n.s.	n.s.	n.s.
Brunei Darussalam	81	76	74	72	188	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Cambodia	609	537	495	464	46	-7	-8	-6	n.s.	n.s.	n.s.
India	2 223	2 377	2 615	2 800	41	15	48	37	n.s.	n.s.	n.s.
Indonesia	16 335	15 182	14 299	13 017	138	-115	-177	-256	1.5	-1.3	-1.7
Lao People's Democratic Republic	1 186	1 133	1 106	1 074	68	-5	-5	-6	n.s.	n.s.	n.s.
Malaysia	2 822	3 558	3 362	3 212	157	74	-39	-30	3.9	-0.8	-0.8
Maldives	–	–	–	–	–	–	–	–	–	–	–
Myanmar	2 040	1 814	1 734	1 654	52	-23	-16	-16	n.s.	n.s.	n.s.
Nepal	602	520	485	485	133	-8	-7	0	0.8	n.s.	0
Pakistan	330	271	243	213	126	-6	-6	-6	n.s.	n.s.	n.s.
Philippines	641	655	660	663	87	1	1	1	-0.6	-0.6	-0.6
Singapore	–	–	–	–	–	–	–	–	–	–	–
Sri Lanka	90	74	66	61	33	-2	-2	-1	n.s.	n.s.	n.s.
Thailand	908	881	877	880	46	-3	-1	1	n.s.	n.s.	n.s.
Timor-Leste	–	–	–	–	–	–	–	–	–	–	–
Viet Nam	778	927	960	992	72	15	7	6	n.s.	-1.1	n.s.
South and Southeast Asia	–	–	–	–	–	–	–	–	–	–	–
Afghanistan	38	38	38	38	28	0	0	0	0	0	0
Armenia	17	15	14	13	48	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Azerbaijan	54	54	54	54	58	0	0	0	0	0	0
Bahrain	–	–	–	–	–	–	–	–	–	–	–
Cyprus	3	3	3	3	18	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Georgia	192	203	207	212	77	1	1	1	n.s.	n.s.	n.s.
Iran (Islamic Republic of)	249	249	254	258	23	n.s.	1	1	n.s.	n.s.	n.s.
Iraq	–	–	–	–	–	–	–	–	–	–	–
Israel	5	5	5	5	31	n.s.	n.s.	n.s.	-0.7	n.s.	n.s.
Jordan	2	2	2	2	24	0	0	0	0	0	0
Kazakhstan	137	137	137	137	41	n.s.	n.s.	0	n.s.	n.s.	n.s.
Kuwait	–	–	–	–	–	–	–	–	–	–	–
Kyrgyzstan	27	34	37	56	59	1	1	4	0.7	0.7	3.2

TABLE 11 (continued)
Trends in carbon stock in living forest biomass 1990–2010

Country/area	Carbon stock in living forest biomass (million tonnes)					Annual change (1 000 t/yr)			Annual change per hectare (t/ha/yr)		
	1990	2000	2005	2010	Per hectare 2010 (tonnes)	1990–2000	2000–2005	2005–2010	1990–2000	2000–2005	2005–2010
Lebanon	–	–	2	2	13	–	–	n.s.	–	–	n.s.
Occupied Palestinian Territory	–	–	–	–	–	–	–	–	–	–	–
Oman	–	–	–	–	–	–	–	–	–	–	–
Qatar	0	0	0	0	–	0	0	0	–	–	–
Saudi Arabia	6	6	6	6	6	0	0	0	0	0	0
Syrian Arab Republic	–	–	–	–	–	–	–	–	–	–	–
Tajikistan	3	3	3	3	7	n.s.	0	0	n.s.	0	0
Turkey	686	743	782	822	73	6	8	8	n.s.	n.s.	n.s.
Turkmenistan	11	11	12	12	3	0	n.s.	0	0	n.s.	0
United Arab Emirates	12	15	16	16	50	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Uzbekistan	8	14	18	19	6	1	1	n.s.	n.s.	n.s.	n.s.
Yemen	5	5	5	5	9	0	0	0	0	0	0
Western and Central Asia	–	–	–	–	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–	–	–	–	–
Albania	49	49	48	49	63	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Andorra	–	–	–	–	–	–	–	–	–	–	–
Austria	339	375	399	393	101	4	5	–1	0.8	1.1	n.s.
Belarus	386	482	540	611	71	10	12	14	0.9	1.2	1.3
Belgium	50	61	63	64	95	1	n.s.	n.s.	1.7	0.5	n.s.
Bosnia and Herzegovina	96	118	118	118	54	2	0	0	1.1	0	0
Bulgaria	127	161	182	202	51	3	4	4	1.0	n.s.	n.s.
Croatia	190	221	237	253	132	3	3	3	1.5	1.4	1.4
Czech Republic	287	322	339	356	134	4	3	3	1.3	1.2	1.1
Denmark	22	26	36	37	68	n.s.	2	n.s.	n.s.	3.1	n.s.
Estonia	–	168	167	165	74	–	n.s.	n.s.	–	n.s.	n.s.
Faroe Islands	–	–	–	–	–	–	–	–	–	–	–
Finland	721	802	832	832	38	8	6	0	n.s.	n.s.	0
France	965	1 049	1 165	1 208	76	8	23	9	n.s.	1.2	n.s.
Germany	981	1 193	1 283	1 405	127	21	18	24	1.6	1.6	2.2
Gibraltar	0	0	0	0	–	0	0	0	–	–	–
Greece	67	73	76	79	20	1	1	1	n.s.	n.s.	n.s.
Guernsey	–	–	–	–	–	–	–	–	–	–	–
Holy See	0	0	0	0	–	0	0	0	–	–	–
Hungary	117	130	136	142	70	1	1	1	n.s.	n.s.	n.s.
Iceland	n.s.	n.s.	n.s.	n.s.	9	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Ireland	16	18	20	23	31	n.s.	n.s.	1	–0.5	n.s.	n.s.
Isle of Man	–	–	–	–	–	–	–	–	–	–	–
Italy	375	467	512	558	61	9	9	9	0.6	0.5	n.s.
Jersey	–	–	–	–	–	–	–	–	–	–	–
Latvia	193	234	244	272	81	4	2	5	1.1	n.s.	1.4
Liechtenstein	n.s.	1	1	1	74	n.s.	0	0	n.s.	0	0
Lithuania	134	146	151	153	71	1	1	n.s.	n.s.	n.s.	n.s.
Luxembourg	7	9	9	9	108	n.s.	0	0	2.2	0	0
Malta	n.s.	n.s.	n.s.	n.s.	173	0	0	0	0	0	0
Monaco	0	0	0	0	–	0	0	0	–	–	–
Montenegro	33	33	33	33	61	0	0	0	0	0	0
Netherlands	21	24	26	28	76	n.s.	n.s.	n.s.	0.7	0.7	1.2
Norway	280	323	360	395	39	4	7	7	n.s.	n.s.	n.s.
Poland	691	807	887	968	104	12	16	16	1.1	1.5	1.5
Portugal	–	–	102	102	30	–	–	n.s.	–	–	n.s.
Republic of Moldova	22	26	28	29	75	n.s.	n.s.	n.s.	1.1	-1.0	n.s.

TABLE 11 (continued)
Trends in carbon stock in living forest biomass 1990–2010

Country/area	Carbon stock in living forest biomass (million tonnes)					Annual change (1 000 t/yr)			Annual change per hectare (t/ha/yr)		
	1990	2000	2005	2010	Per hectare 2010 (tonnes)	1990–2000	2000–2005	2005–2010	1990–2000	2000–2005	2005–2010
Romania	600	599	601	618	94	n.s.	n.s.	3	n.s.	n.s.	n.s.
Russian Federation	32 504	32 157	32 210	32 500	40	-35	11	58	n.s.	n.s.	n.s.
San Marino	0	0	0	0	–	0	0	0	–	–	–
Serbia	122	138	147	240	88	2	2	19	n.s.	0.6	5.8
Slovakia	163	190	202	211	109	3	3	2	1.4	1.2	0.9
Slovenia	116	141	159	178	142	2	4	4	1.6	2.8	2.8
Spain	289	396	400	422	23	11	1	4	n.s.	n.s.	n.s.
Svalbard and Jan Mayen Islands	0	0	0	0	–	0	0	0	–	–	–
Sweden	1 178	1 183	1 219	1 255	45	n.s.	7	7	n.s.	n.s.	n.s.
Switzerland	126	136	139	143	115	1	1	1	n.s.	n.s.	n.s.
The former Yugoslav Republic of Macedonia	60	62	60	60	61	n.s.	n.s.	0	n.s.	-0.6	n.s.
Ukraine	499	662	712	761	78	16	10	10	1.6	0.9	0.8
United Kingdom	120	119	128	136	47	n.s.	2	2	n.s.	n.s.	n.s.
Europe	–	–	–	–	–	–	–	–	–	–	–
Anguilla	–	–	–	–	–	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	–	–	–	–	–	–
Bahamas	–	–	–	–	–	–	–	–	–	–	–
Barbados	–	–	–	–	–	–	–	–	–	–	–
Bermuda	–	–	–	–	–	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–	–	–	–	–	–
Cuba	113	180	212	226	79	7	6	3	1.9	0.9	n.s.
Dominica	–	–	–	–	–	–	–	–	–	–	–
Dominican Republic	114	114	114	114	58	0	0	0	0	0	0
Grenada	1	1	1	1	63	0	n.s.	n.s.	0	-5.6	2.8
Guadeloupe	13	13	13	12	195	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Haiti	6	6	6	5	54	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Jamaica	48	48	48	48	141	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Martinique	–	8	8	8	173	–	0	0	–	0	0
Montserrat	–	–	–	–	–	–	–	–	–	–	–
Netherlands Antilles	–	–	–	–	–	–	–	–	–	–	–
Puerto Rico	14	23	26	28	51	1	n.s.	n.s.	n.s.	n.s.	n.s.
Saint Kitts and Nevis	–	–	–	–	–	–	–	–	–	–	–
Saint Lucia	–	–	–	–	–	–	–	–	–	–	–
Saint Martin (French part)	–	–	–	–	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	–	–	–	–	–	–	–	–	–	–
Saint Barthélemy	0	0	0	0	–	0	0	0	–	–	–
Trinidad and Tobago	21	20	20	19	85	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Turks and Caicos Islands	–	–	–	–	–	–	–	–	–	–	–
United States Virgin Islands	1	1	1	1	27	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Caribbean	–	–	–	–	–	–	–	–	–	–	–
Belize	195	184	178	171	123	-1	-1	-1	n.s.	n.s.	n.s.
Costa Rica	233	217	227	238	91	-2	2	2	n.s.	n.s.	n.s.
El Salvador	–	–	–	–	–	–	–	–	–	–	–
Guatemala	365	324	303	281	77	-4	-4	-4	n.s.	n.s.	n.s.
Honduras	517	407	368	330	64	-11	-8	-8	n.s.	n.s.	n.s.
Nicaragua	506	428	389	349	112	-8	-8	-8	n.s.	n.s.	n.s.
Panama	429	381	374	367	113	-5	-1	-1	n.s.	n.s.	n.s.
Central America	–	–	–	–	–	–	–	–	–	–	–

TABLE 11 (continued)
Trends in carbon stock in living forest biomass 1990–2010

Country/area	Carbon stock in living forest biomass (million tonnes)					Annual change (1 000 t/yr)			Annual change per hectare (t/ha/yr)		
	1990	2000	2005	2010	Per hectare 2010 (tonnes)	1990–2000	2000–2005	2005–2010	1990–2000	2000–2005	2005–2010
Canada[a]	14 284	14 317	14 021	13 908	45	3	-59	-23	n.s.	n.s.	n.s.
Greenland	–	–	–	–	–	–	–	–	–	–	–
Mexico	2 186	2 111	2 076	2 043	32	-8	-7	-7	n.s.	n.s.	n.s.
Saint Pierre and Miquelon	–	–	–	–	–	–	–	–	–	–	–
United States of America	16 951	17 998	18 631	19 308	64	105	127	135	n.s.	n.s.	n.s.
North America	–	–	–	–	–	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–	–	–	–	–	–
American Samoa	2	2	2	2	110	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Australia	6 724	6 702	6 641	–	–	-2	-12	–	n.s.	n.s.	–
Cook Islands	–	–	–	–	–	–	–	–	–	–	–
Fiji	–	–	–	–	–	–	–	–	–	–	–
French Polynesia	–	–	–	21	132	–	–	–	–	–	–
Guam	2	2	2	2	69	0	0	0	0	0	0
Kiribati	–	–	–	–	–	–	–	–	–	–	–
Marshall Islands	2	2	2	2	183	0	0	0	0	0	0
Micronesia (Federated States of)	20	20	20	20	318	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Nauru	0	0	0	0	–	0	0	0	–	–	–
New Caledonia	60	60	60	60	72	0	0	0	0	0	0
New Zealand	–	–	1 263	1 292	156	–	–	6	–	–	0.9
Niue	–	–	–	–	–	–	–	–	–	–	–
Norfolk Island	–	–	–	–	–	–	–	–	–	–	–
Northern Mariana Islands	3	3	3	3	100	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Palau	10	10	11	11	264	n.s.	n.s.	0	n.s.	n.s.	0
Papua New Guinea	2 537	2 423	2 365	2 306	80	-11	-11	-12	n.s.	n.s.	n.s.
Pitcairn	–	–	–	–	–	–	–	–	–	–	–
Samoa	–	–	–	–	–	–	–	–	–	–	–
Solomon Islands	191	186	184	182	82	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Tokelau	0	0	0	0	–	0	0	0	–	–	–
Tonga	1	1	1	1	114	0	0	0	0	0	0
Tuvalu	–	–	–	–	–	–	–	–	–	–	–
Vanuatu	–	–	–	–	–	–	–	–	–	–	–
Wallis and Futuna Islands	–	–	–	–	–	–	–	–	–	–	–
Oceania	–	–	–	–	–	–	–	–	–	–	–
Argentina	3 414	3 236	3 143	3 062	104	-18	-19	-16	n.s.	n.s.	n.s.
Bolivia (Plurinational State of)	4 877	4 666	4 561	4 442	78	-21	-21	-24	n.s.	n.s.	n.s.
Brazil	68 119	65 304	63 679	62 607	121	-282	-325	-214	n.s.	n.s.	n.s.
Chile	1 294	1 328	1 338	1 349	83	3	2	2	n.s.	n.s.	n.s.
Colombia	7 032	6 918	6 862	6 805	112	-11	-11	-11	n.s.	n.s.	n.s.
Ecuador	–	–	–	–	–	–	–	–	–	–	–
Falkland Islands (Malvinas)*	0	0	0	0	–	0	0	0	–	–	–
French Guiana	1 672	1 657	1 654	1 651	204	-2	-1	-1	n.s.	n.s.	n.s.
Guyana	1 629	1 629	1 629	1 629	107	0	0	0	0	0	0
Paraguay	–	–	–	–	–	–	–	–	–	–	–
Peru	8 831	8 713	8 654	8 560	126	-12	-12	-19	n.s.	n.s.	n.s.
Suriname	3 168	3 168	3 168	3 165	214	0	0	-1	0	0	n.s.
Uruguay	–	–	–	–	–	–	–	–	–	–	–
Venezuela (Bolivarian Republic of)	–	–	–	–	–	–	–	–	–	–	–
South America	–	–	–	–	–	–	–	–	–	–	–
World	–	–	–	–	–	–	–	–	–	–	–

[a] Data for Canada only cover forests classified as "Managed Forest" as defined by the UNFCCC, not the total forest area.
* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 12
Area of forest affected by fire and other disturbances 2005[a]

Country/area	Forest fire		Insects (1 000 ha)	Diseases (1 000 ha)	Other biotic agents (1 000 ha)	Abiotic factors (1 000 ha)	Total (excluding fire)[b]	
	1 000 ha	% wild fire					1 000 ha	% of forest area in 2005
Angola	–	–	–	–	–	–	–	–
Botswana	399	–	–	–	–	–	–	–
Comoros	0	–	0	0	0	0	0	0
Djibouti	–	–	–	–	–	–	–	–
Eritrea	–	–	–	–	–	–	–	–
Ethiopia	–	–	–	–	–	–	–	–
Kenya	2	100	–	–	–	–	–	–
Lesotho	–	–	–	–	–	–	–	–
Madagascar	16	100	0	0	0	–	–	–
Malawi	–	–	–	–	–	–	–	–
Mauritius	n.s.	100	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Mayotte	–	–	0	0	0	0	0	0
Mozambique	–	100	–	–	–	–	–	–
Namibia	–	–	–	–	–	–	–	–
Réunion	n.s.	100	–	–	–	–	–	–
Seychelles	–	100	–	–	–	–	–	–
Somalia	–	–	–	–	–	–	–	–
South Africa	–	–	–	–	–	–	–	–
Swaziland	–	–	–	–	–	–	–	–
Uganda	–	–	–	–	–	–	–	–
United Republic of Tanzania	15	100	–	–	–	–	–	–
Zambia	–	–	–	–	–	–	–	–
Zimbabwe	20	–	–	–	–	–	–	–
Eastern and Southern Africa	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Algeria	12	100	217	–	–	–	217	14
Egypt	0	–	1	n.s.	n.s.	0	1	2
Libyan Arab Jamahiriya	–	–	–	–	–	–	–	–
Mauritania	1	100	–	–	–	–	–	–
Morocco	4	100	33	–	16	–	49	1
Sudan	–	100	–	–	–	–	–	–
Tunisia	n.s.	100	10	0	0	n.s.	10	1
Western Sahara	–	–	–	–	–	–	–	–
Northern Africa	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Benin	47	40	–	–	–	–	–	–
Burkina Faso	–	–	–	–	–	–	–	–
Burundi	–	–	–	–	–	–	–	–
Cameroon	497	83	–	–	–	–	–	–
Cape Verde	n.s.	–	–	–	–	–	–	–
Central African Republic	–	–	–	–	–	–	–	–
Chad	5 794	100	–	–	–	–	–	–
Congo	–	–	–	–	–	–	–	–
Côte d'Ivoire	–	–	0	0	–	–	–	–
Democratic Republic of the Congo	–	–	–	–	–	–	–	–
Equatorial Guinea	–	–	–	–	–	–	–	–
Gabon	–	–	–	–	–	–	–	–
Gambia	–	100	0	0	283	–	–	–
Ghana	500	80	2	2	–	–	–	–
Guinea	–	100	–	–	–	–	–	–

TABLE 12 (continued)
Area of forest affected by fire and other disturbances 2005[a]

Country/area	Forest fire		Insects (1 000 ha)	Diseases (1 000 ha)	Other biotic agents (1 000 ha)	Abiotic factors (1 000 ha)	Total (excluding fire)[b]	
	1 000 ha	% wild fire					1 000 ha	% of forest area in 2005
Guinea-Bissau	–	–	–	–	–	–	–	–
Liberia	–	–	–	–	–	–	–	–
Mali	168	68	–	–	–	–	–	–
Niger	27	0	–	2	–	–	–	–
Nigeria	–	–	–	–	–	–	–	–
Rwanda	–	–	–	–	–	–	–	–
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–	–	–
Sao Tome and Principe	–	–	–	–	–	–	–	–
Senegal	816	14	–	–	–	–	–	–
Sierra Leone	–	90	–	–	–	–	–	–
Togo	–	–	–	–	–	–	–	–
Western and Central Africa	–	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–	–
China	221	11	3 152	348	749	–	4 250	2
Democratic People's Republic of Korea	46	–	–	–	–	–	–	–
Japan	1	100	n.s.	1	6	19	26	n.s.
Mongolia	280	100	611	–	–	–	–	–
Republic of Korea	1	100	315	0	–	–	315	5
East Asia	–	–	–	–	–	–	–	–
Bangladesh	–	–	146	–	–	–	–	–
Bhutan	7	100	n.s.	n.s.	–	n.s.	n.s.	n.s.
Brunei Darussalam	–	–	–	–	–	–	–	–
Cambodia	–	–	–	–	–	–	–	–
India	1 605	100	839	0	25 499	4 383	29 882	44
Indonesia	5	100	–	–	–	–	–	–
Lao People's Democratic Republic	–	–	–	–	–	–	–	–
Malaysia	2	100	–	–	–	–	–	–
Maldives	–	–	–	–	–	–	–	–
Myanmar	218	–	–	–	–	–	–	–
Nepal	–	–	–	–	–	–	–	–
Pakistan	–	100	–	–	–	–	–	–
Philippines	2	100	n.s.	n.s.	0	n.s.	n.s.	n.s.
Singapore	0	–	0	0	0	0	0	0
Sri Lanka	–	–	–	–	–	–	–	–
Thailand	21	–	–	–	–	–	–	–
Timor-Leste	–	–	–	–	–	–	–	–
Viet Nam	–	–	–	–	–	–	–	–
South and Southeast Asia	–	–	–	–	–	–	–	–
Afghanistan	–	–	–	–	–	–	–	–
Armenia	n.s.	100	46	8	–	–	54	19
Azerbaijan	n.s.	–	5	5	–	–	–	–
Bahrain	–	–	–	–	–	–	–	–
Cyprus	n.s.	100	6	0	4	0	10	6
Georgia	–	100	–	–	–	–	–	–
Iran (Islamic Republic of)	–	–	–	–	–	–	–	–
Iraq	–	–	–	–	–	–	–	–

TABLE 12 (continued)
Area of forest affected by fire and other disturbances 2005[a]

Country/area	Forest fire		Insects (1 000 ha)	Diseases (1 000 ha)	Other biotic agents (1 000 ha)	Abiotic factors (1 000 ha)	Total (excluding fire)[b]	
	1 000 ha	% wild fire					1 000 ha	% of forest area in 2005
Israel	1	100	3	n.s.	0	n.s.	3	2
Jordan	1	100	–	–	–	–	–	–
Kazakhstan	35	–	–	–	–	–	–	–
Kuwait	–	–	–	–	–	–	–	–
Kyrgyzstan	n.s.	100	29	1	–	–	30	3
Lebanon	2	100	1	1	0	2	4	3
Occupied Palestinian Territory	–	–	–	–	–	–	–	–
Oman	0	–	–	–	–	–	–	–
Qatar	0	–	0	0	0	0	0	–
Saudi Arabia	5	–	4	3	–	–	7	1
Syrian Arab Republic	n.s.	100	1	–	–	–	–	–
Tajikistan	1	100	20	4	–	–	24	6
Turkey	5	100	172	12	–	11	195	2
Turkmenistan	–	–	–	–	–	–	–	–
United Arab Emirates	0	–	5	0	0	0	5	2
Uzbekistan	n.s.	100	16	9	–	–	25	1
Yemen	–	–	–	–	–	–	–	–
Western and Central Asia	–	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–	–
Albania	6	100	1	1	101	n.s.	–	–
Andorra	–	–	–	–	–	–	–	–
Austria	n.s.	100	53	112	–	29	195	5
Belarus	1	100	41	164	n.s.	6	212	3
Belgium	n.s.	100	20	25	40	–	–	–
Bosnia and Herzegovina	–	–	–	–	–	–	–	–
Bulgaria	11	100	82	32	1	7	122	3
Croatia	7	100	27	10	8	19	65	3
Czech Republic	1	100	13	48	1	24	87	3
Denmark	n.s.	100	4	2	15	34	55	10
Estonia	1	100	1	3	2	12	18	1
Faroe Islands	–	–	–	–	–	–	–	–
Finland	1	100	1	2	10	6	18	n.s.
France	25	–	–	–	–	n.s.	–	–
Germany	1	100	269	–	–	26	–	–
Gibraltar	0	–	0	0	0	0	0	–
Greece	–	–	–	–	–	–	–	–
Guernsey	–	–	–	–	–	–	–	–
Holy See	0	–	0	0	0	0	0	–
Hungary	2	100	155	25	28	30	245	12
Iceland	0	–	n.s.	–	–	–	–	–
Ireland	1	100	0	0	0	n.s.	n.s.	n.s.
Isle of Man	–	–	–	–	–	–	–	–
Italy	29	100	347	591	323	584	1 845	21
Jersey	–	–	–	–	–	–	–	–
Latvia	1	100	n.s.	n.s.	n.s.	5	5	n.s.
Liechtenstein	0	–	–	–	–	–	–	–
Lithuania	n.s.	100	29	23	12	38	102	5
Luxembourg	0	–	–	n.s.	–	–	–	–

TABLE 12 (continued)
Area of forest affected by fire and other disturbances 2005[a]

Country/area	Forest fire		Insects (1 000 ha)	Diseases (1 000 ha)	Other biotic agents (1 000 ha)	Abiotic factors (1 000 ha)	Total (excluding fire)[b]	
	1 000 ha	% wild fire					1 000 ha	% of forest area in 2005
Malta	0	–	–	–	–	–	–	–
Monaco	0	–	0	0	0	0	0	–
Montenegro	–	–	–	–	–	–	–	–
Netherlands	n.s.	100	0	0	0	–	0	0
Norway	1	100	17	14	49	35	103	1
Poland	8	100	118	49	61	248	–	–
Portugal	104	100	604	143	44	51	843	25
Republic of Moldova	n.s.	–	42	42	–	–	–	–
Romania	1	100	1 266	56	10	231	1 563	24
Russian Federation	991	100	1 668	1 132	–	1 351	4 152	1
San Marino	0	–	0	0	0	0	0	–
Serbia	4	100	118	–	–	–	118	5
Slovakia	1	99	10	9	1	16	34	2
Slovenia	1	100	1	n.s.	n.s.	1	2	n.s.
Spain	55	–	–	–	–	–	–	–
Svalbard and Jan Mayen Islands	0	–	0	0	0	0	0	–
Sweden	2	100	42	314	1 777	1 233	3 366	12
Switzerland	n.s.	100	3	–	–	0	–	–
The former Yugoslav Republic of Macedonia	4	100	44	3	–	–	–	–
Ukraine	5	100	148	117	n.s.	7	272	3
United Kingdom	1	100	1	0	3	6	10	n.s.
Europe	–	–	–	–	–	–	–	–
Anguilla	–	–	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	–	–	–
Bahamas	–	–	–	–	–	–	–	–
Barbados	–	100	0	0	0	0	0	0
Bermuda	–	–	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–	–	–
Cuba	9	100	n.s.	n.s.	–	2	2	n.s.
Dominica	–	–	–	–	–	–	–	–
Dominican Republic	3	–	–	–	–	–	–	–
Grenada	n.s.	–	0	0	0	0	0	0
Guadeloupe	0	–	2	–	–	–	–	–
Haiti	–	–	–	–	–	–	–	–
Jamaica	–	–	0	0	0	n.s.	n.s.	n.s.
Martinique	–	–	–	–	–	–	–	–
Montserrat	0	–	–	–	–	–	–	–
Netherlands Antilles	–	–	–	–	–	–	–	–
Puerto Rico	–	–	–	–	–	–	–	–
Saint Kitts and Nevis	–	–	–	–	–	–	–	–
Saint Lucia	–	–	–	–	–	–	–	–
Saint Martin (French part)	–	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	–	–	–	–	–	–	–
Saint Barthélemy	0	–	0	0	0	0	0	–
Trinidad and Tobago	3	100	0	0	0	0	0	0

TABLE 12 (continued)
Area of forest affected by fire and other disturbances 2005[a]

Country/area	Forest fire		Insects (1 000 ha)	Diseases (1 000 ha)	Other biotic agents (1 000 ha)	Abiotic factors (1 000 ha)	Total (excluding fire)[b]	
	1 000 ha	% wild fire					1 000 ha	% of forest area in 2005
Turks and Caicos Islands	–	–	–	–	–	–	–	–
United States Virgin Islands	–	–	–	–	–	–	–	–
Caribbean	–	–	–	–	–	–	–	–
Belize	–	–	–	–	–	–	–	–
Costa Rica	7	–	–	–	–	–	–	–
El Salvador	–	–	1	–	–	–	1	n.s.
Guatemala	–	–	1	n.s.	–	–	–	–
Honduras	33	95	5	–	–	–	–	–
Nicaragua	63	100	–	–	–	–	–	–
Panama	3	–	–	–	–	–	–	–
Central America	–	–	–	–	–	–	–	–
Canada	1 230	100	17 273	–	–	–	–	–
Greenland	0	–	–	–	–	–	–	–
Mexico	38	92	38	19	4	–	61	n.s.
Saint Pierre and Miquelon	–	–	n.s.	0	3	–	3	100
United States of America	2 169	66	5 640	–	–	–	–	–
North America	–	–	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–	–	–
American Samoa	–	–	–	–	–	–	–	–
Australia	3 903	78	–	–	–	–	–	–
Cook Islands	–	–	–	–	–	–	–	–
Fiji	–	–	–	–	–	–	–	–
French Polynesia	–	–	–	–	–	–	–	–
Guam	–	–	–	–	–	–	–	–
Kiribati	0	–	–	–	–	–	–	–
Marshall Islands	–	–	–	–	–	–	–	–
Micronesia (Federated States of)	–	–	–	–	–	–	–	–
Nauru	0	–	0	0	0	0	0	–
New Caledonia	–	–	0	0	–	0	–	–
New Zealand	n.s.	100	40	320	140	27	–	–
Niue	–	–	–	–	–	–	–	–
Norfolk Island	–	–	–	–	–	–	–	–
Northern Mariana Islands	–	–	–	–	–	–	–	–
Palau	–	–	–	–	–	–	–	–
Papua New Guinea	–	100	–	–	–	–	–	–
Pitcairn	–	–	–	–	–	–	–	–
Samoa	–	–	–	–	–	–	–	–
Solomon Islands	–	–	–	–	–	–	–	–
Tokelau	0	–	0	0	0	0	0	–
Tonga	0	–	–	–	–	–	–	–
Tuvalu	–	–	–	–	–	–	–	–
Vanuatu	–	–	–	–	–	–	–	–
Wallis and Futuna Islands	–	–	–	–	–	–	–	–
Oceania	–	–	–	–	–	–	–	–
Argentina	305	98	409	–	–	–	–	–
Bolivia (Plurinational State of)	–	–	–	–	–	–	–	–
Brazil	–	100	–	–	–	–	–	–

TABLE 12 (continued)
Area of forest affected by fire and other disturbances 2005[a]

Country/area	Forest fire		Insects (1 000 ha)	Diseases (1 000 ha)	Other biotic agents (1 000 ha)	Abiotic factors (1 000 ha)	Total (excluding fire)[b]	
	1 000 ha	% wild fire					1 000 ha	% of forest area in 2005
Chile	16	100	310	110	15	–	435	3
Colombia	–	–	–	–	–	–	–	–
Ecuador	–	–	n.s.	–	–	–	n.s.	n.s.
Falkland Islands (Malvinas)*	0	–	0	0	0	0	0	–
French Guiana	0	–	0	0	0	0	0	0
Guyana	–	–	–	–	–	–	–	–
Paraguay	–	–	–	–	–	–	–	–
Peru	12	–	8	3	–	–	–	–
Suriname	–	–	–	–	–	–	–	–
Uruguay	–	–	–	–	–	–	–	–
Venezuela (Bolivarian Republic of)	–	–	–	–	–	–	–	–
South America	–	–	–	–	–	–	–	–
World	–	–	–	–	–	–	–	–

[a] Five year average for 2003–2007.
[b] The total area affected by disturbances is not necessarily the sum of the individual disturbances as these may be overlapping.
* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 13
Trends in removals of wood products 1990–2005

Country/area	Industrial roundwood				Woodfuel			
	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)
	1990	2000	2005		1990	2000	2005	
Angola	974	1 253	1 260	100	2 693	3 629	4 108	100
Botswana	76	–	–	–	695	731	759	100
Comoros	8	8	9	100	160	185	197	100
Djibouti	–	–	–	–	–	–	–	–
Eritrea	–	2	1	100	–	2 549	1 475	100
Ethiopia	–	2 812	3 368	100	–	100 376	108 548	100
Kenya	2 003	2 213	1 646	100	19 381	22 631	27 359	100
Lesotho	–	–	n.s.	100	1 771	2 227	2 362	100
Madagascar	928	155	238	100	8 155	11 084	12 812	100
Malawi	476	595	598	100	5 873	5 702	5 919	100
Mauritius	16	11	10	100	14	12	7	100
Mayotte	–	n.s.	n.s.	70	37	29	27	77
Mozambique	1 070	1 511	1 507	–	17 104	19 233	19 233	–
Namibia	–	–	–	–	–	–	–	–
Réunion	5	5	6	100	3	3	2	100
Seychelles	4	8	10	100	6	4	3	100
Somalia	–	–	–	–	–	–	7 922	–
South Africa	15 477	16 746	21 077	100	13 570	13 800	13 800	100
Swaziland	1 170	379	379	100	644	644	848	100
Uganda	2 044	3 620	3 651	–	33 865	39 316	42 310	–
United Republic of Tanzania	2 294	2 653	2 661	100	21 552	23 984	24 970	100
Zambia	764	680	1 179	100	7 309	9 106	10 002	100
Zimbabwe	771	1 205	1 001	100	7 199	9 278	9 473	100
Eastern and Southern Africa	–	–	–	–	–	–	–	–
Algeria	80	136	73	100	50	56	77	100
Egypt	–	75	80	–	–	110	120	–
Libyan Arab Jamahiriya	122	133	133	–	616	616	787	–
Mauritania	6	7	5	–	1 321	1 643	1 865	–
Morocco	508	470	580	100	504	427	367	100
Sudan	2 036	2 489	2 499	57	18 648	19 226	20 347	57
Tunisia	93	111	242	100	116	125	57	100
Western Sahara	4	7	7	100	3	6	6	100
Northern Africa	–	–	–	–	–	–	–	–
Benin	317	380	404	100	6 396	4 132	4 284	100
Burkina Faso	3	5	5	–	6 336	7 243	7 333	–
Burundi	58	372	383	100	6 663	7 845	9 815	100
Cameroon	3 606	3 138	3 306	–	11 255	14 742	16 561	–
Cape Verde	–	–	–	–	–	–	14	–
Central African Republic	496	1 108	765	100	3 231	2 300	2 300	–
Chad	404	424	435	67	8 084	8 486	8 696	67
Congo	1 117	1 189	1 450	100	942	1 235	1 317	100
Côte d'Ivoire	–	2 282	2 175	100	8 826	9 855	10 004	100
Democratic Republic of the Congo	367	918	205	–	51 451	74 592	81 580	–
Equatorial Guinea	200	689	634	100	514	514	514	100
Gabon	75	606	1 098	100	521	591	858	100
Gambia	80	130	130	100	522	653	744	100
Ghana	1 382	1 298	1 508	81	14 833	23 780	23 780	100

TABLE 13 (continued)
Trends in removals of wood products 1990–2005

Country/area	Industrial roundwood				Woodfuel			
	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)
	1990	2000	2005		1990	2000	2005	
Guinea	626	748	749	100	10 787	12 431	13 441	100
Guinea-Bissau	20	7	7	–	22	33	35	–
Liberia	609	856	370	100	3 843	5 226	6 678	100
Mali	402	473	474	100	4 559	5 439	5 778	100
Niger	454	579	701	–	9 089	11 572	14 023	–
Nigeria	9 321	10 831	10 831	100	59 095	68 172	70 427	100
Rwanda	133	472	569	40	4 823	6 831	7 801	90
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–	–	–
Sao Tome and Principe	10	10	10	–	–	–	–	–
Senegal	8	15	43	91	4 687	5 115	5 276	67
Sierra Leone	152	142	142	100	5 383	6 070	6 242	100
Togo	–	3 684	3 320	100	–	3 370	3 012	100
Western and Central Africa	–	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–	–
China	64 814	55 502	63 882	100	63 600	75 948	63 676	100
Democratic People's Republic of Korea	690	1 725	1 725	100	5 055	6 318	6 626	100
Japan	30 765	18 601	17 803	100	365	242	160	100
Mongolia	584	100	50	100	624	472	574	70
Republic of Korea	1 204	1 570	2 278	100	402	266	293	100
East Asia	–	–	–	–	–	–	–	–
Bangladesh	240	249	253	–	562	865	1 016	–
Bhutan	170	195	216	100	143	95	93	100
Brunei Darussalam	97	119	128	–	–	n.s.	n.s.	–
Cambodia	625	182	4	–	94	0	1	–
India	35 055	41 173	45 957	6	213 169	245 837	260 752	20
Indonesia	25 485	17 792	14 428	100	144 680	101 098	86 396	–
Lao People's Democratic Republic	477	682	292	–	6 488	6 742	6 825	–
Malaysia	48 428	21 946	26 706	–	4 613	3 831	3 557	–
Maldives	–	–	–	–	–	–	–	–
Myanmar	3 397	3 604	3 880	–	35 687	37 104	39 180	–
Nepal	28	81	152	100	91	64	41	100
Pakistan	2 434	2 345	2 301	–	24 740	29 315	31 603	–
Philippines	2 568	628	791	100	123	116	349	100
Singapore	0	0	0	–	0	0	0	–
Sri Lanka	772	766	763	–	8 583	6 780	6 476	–
Thailand	176	45	11	100	534	6	7	100
Timor-Leste	–	–	–	–	–	1 300	1 300	–
Viet Nam	3 446	2 376	2 703	100	26 534	26 685	26 240	100
South and Southeast Asia	–	–	–	–	–	–	–	–
Afghanistan	1 698	2 019	2 024	–	797	1 449	1 681	–
Armenia	9	8	11	100	79	66	76	100
Azerbaijan	–	31	4	–	–	31	4	–
Bahrain	–	–	–	–	–	–	–	–
Cyprus	43	20	9	–	13	7	5	–
Georgia	103	91	111	100	248	299	666	100
Iran (Islamic Republic of)	1 256	2 050	2 448	–	425	55	20	–

TABLE 13 (continued)
Trends in removals of wood products 1990–2005

Country/area	Industrial roundwood				Woodfuel			
	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)
	1990	2000	2005		1990	2000	2005	
Iraq	–	–	–	–	–	–	–	–
Israel	76	81	22	100	2	2	5	100
Jordan	–	–	–	–	9	2	5	–
Kazakhstan	2 024	189	535	–	577	483	231	–
Kuwait	–	–	–	–	–	–	–	–
Kyrgyzstan	7	13	9	100	–	32	16	100
Lebanon	0	0	0	–	–	–	18	70
Occupied Palestinian Territory	–	–	–	–	–	–	–	–
Oman	–	–	–	–	–	–	–	–
Qatar	–	–	–	–	–	–	–	–
Saudi Arabia	0	0	0	–	–	–	8	–
Syrian Arab Republic	–	–	–	–	–	–	–	–
Tajikistan	0	0	0	–	6	7	7	100
Turkey	9 946	11 514	11 905	72	15 680	11 116	9 722	87
Turkmenistan	0	0	0	–	10	10	10	–
United Arab Emirates	0	0	0	–	–	–	–	–
Uzbekistan	3	5	9	100	46	24	21	100
Yemen	–	–	–	–	205	347	422	–
Western and Central Asia	–	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–	–
Albania	244	43	27	100	561	167	164	67
Andorra	–	–	–	–	–	–	–	–
Austria	11 535	12 019	15 488	100	3 002	3 316	4 414	100
Belarus	5 479	4 876	6 571	100	822	951	1 074	100
Belgium	3 852	2 957	3 789	100	500	500	600	100
Bosnia and Herzegovina	3 791	3 259	3 006	100	982	1 067	1 337	100
Bulgaria	2 457	2 799	3 772	100	943	979	1 938	100
Croatia	–	2 646	3 077	100	–	961	1 181	100
Czech Republic	11 874	14 836	16 786	100	1 156	1 023	1 487	100
Denmark	1 498	1 456	1 231	100	451	644	1 080	100
Estonia	–	8 975	4 565	98	–	2 194	1 590	98
Faroe Islands	–	–	–	–	–	–	–	–
Finland	43 840	55 721	55 152	100	3 371	5 112	5 933	100
France	35 389	38 028	33 295	100	36 700	31 251	29 099	74
Germany	37 043	47 265	58 788	100	7 646	12 497	16 548	100
Gibraltar	–	–	–	–	–	–	–	–
Greece	1 168	681	689	–	1 811	1 540	1 195	–
Guernsey	–	–	–	–	–	–	–	–
Holy See	–	–	–	–	–	–	–	–
Hungary	4 129	3 860	3 452	100	2 615	2 322	2 943	100
Iceland	n.s.	n.s.	1	100	n.s.	n.s.	n.s.	100
Ireland	1 618	2 710	2 890	100	50	57	25	–
Isle of Man	–	–	–	–	–	–	–	–
Italy	4 982	4 031	3 499	100	4 895	6 000	6 542	100
Jersey	–	–	–	–	–	–	–	–
Latvia	2 781	12 288	13 129	100	2 165	2 194	3 230	78
Liechtenstein	16	16	21	–	5	5	5	–

TABLE 13 (continued)
Trends in removals of wood products 1990–2005

Country/area	Industrial roundwood				Woodfuel			
	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)
	1990	2000	2005		1990	2000	2005	
Lithuania	2 779	4 665	5 446	100	872	1 506	1 452	100
Luxembourg	–	333	226	100	–	1	14	100
Malta	0	0	0	–	0	0	0	–
Monaco	–	–	–	–	–	–	–	–
Montenegro	–	–	221	–	–	–	305	–
Netherlands	1 363	949	934	100	154	187	343	100
Norway	11 300	8 854	8 877	100	1 175	1 450	1 582	100
Poland	22 783	29 598	35 572	99	4 338	3 382	4 635	91
Portugal	12 662	10 958	12 578	100	627	732	732	100
Republic of Moldova	43	38	41	–	270	277	299	–
Romania	–	–	–	–	–	–	–	–
Russian Federation	268 396	104 546	134 870	100	68 131	47 770	50 905	100
San Marino	–	–	–	–	–	–	–	–
Serbia	1 149	946	1 002	100	1 761	1 189	1 306	90
Slovakia	5 073	5 819	8 260	100	472	331	406	100
Slovenia	2 701	2 058	2 368	100	277	489	868	100
Spain	14 794	14 828	15 827	–	2 947	2 045	1 760	–
Svalbard and Jan Mayen Islands	–	–	–	–	–	–	–	–
Sweden	56 476	64 729	75 539	100	3 602	6 726	10 826	100
Switzerland	4 406	5 154	4 544	100	843	1 144	1 250	100
The former Yugoslav Republic of Macedonia	–	129	132	–	–	520	480	–
Ukraine	8 577	7 814	11 387	100	5 013	4 417	5 290	100
United Kingdom	6 901	8 452	9 149	100	256	259	352	100
Europe	–	–	–	–	–	–	–	–
Anguilla	–	–	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	–	–	–
Bahamas	132	20	20	–	–	–	–	–
Barbados	–	–	–	–	–	–	–	–
Bermuda	–	–	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–	–	–
Cuba	577	687	639	–	2 512	1 746	1 588	–
Dominica	–	–	–	–	–	–	–	–
Dominican Republic	7	7	32	–	639	639	732	–
Grenada	n.s.	n.s.	n.s.	–	–	–	–	–
Guadeloupe	1	1	n.s.	100	17	17	25	100
Haiti	275	275	275	100	1 890	2 257	2 300	100
Jamaica	–	1	4	91	–	–	–	–
Martinique	–	5	3	100	–	–	–	–
Montserrat	–	–	–	–	–	–	–	–
Netherlands Antilles	–	–	–	–	–	–	–	–
Puerto Rico	–	–	–	–	–	–	–	–
Saint Kitts and Nevis	–	–	–	–	–	–	–	–
Saint Lucia	–	–	–	–	–	–	–	–
Saint Martin (French part)	–	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	–	–	–	–	–	–	–

TABLE 13 (continued)
Trends in removals of wood products 1990–2005

Country/area	Industrial roundwood				Woodfuel			
	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)
	1990	2000	2005		1990	2000	2005	
Saint Barthélemy	–	–	–	–	–	–	–	–
Trinidad and Tobago	52	59	54	100	46	42	40	100
Turks and Caicos Islands	–	–	–	–	–	–	–	–
United States Virgin Islands	–	–	–	–	–	–	–	–
Caribbean	–	–	–	–	–	–	–	–
Belize	71	71	59	–	145	145	270	–
Costa Rica	1 198	776	1 006	75	–	468	468	–
El Salvador	162	760	784	–	4 343	5 196	4 814	–
Guatemala	–	594	800	–	–	396	533	–
Honduras	887	968	1 001	–	9 798	10 008	9 984	–
Nicaragua	–	112	216	100	–	11	33	–
Panama	123	60	157	–	1 606	1 468	1 385	–
Central America	–	–	–	–	–	–	–	–
Canada	188 753	212 012	214 057	–	7 112	3 292	3 251	–
Greenland	–	–	–	–	–	–	–	–
Mexico	7 653	7 662	6 055	100	451	547	688	100
Saint Pierre and Miquelon	0	0	0	–	–	–	1	100
United States of America	499 193	495 740	481 006	100	97 725	51 779	51 101	67
North America	–	–	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–	–	–
American Samoa	–	–	–	–	–	–	–	–
Australia	16 791	23 035	26 672	100	3 540	5 547	–	–
Cook Islands	0	6	6	100	–	–	–	–
Fiji	318	287	506	–	17	22	190	–
French Polynesia	–	–	1	100	–	–	–	–
Guam	–	–	–	–	–	–	–	–
Kiribati	–	–	–	–	–	–	–	–
Marshall Islands	–	–	–	–	–	–	–	–
Micronesia (Federated States of)	–	–	–	–	–	–	–	–
Nauru	–	–	–	–	–	–	–	–
New Caledonia	7	10	13	100	–	–	–	–
New Zealand	13 842	21 280	23 734	100	–	–	–	–
Niue	–	–	–	–	–	–	–	–
Norfolk Island	–	–	–	–	–	–	–	–
Northern Mariana Islands	–	–	–	–	–	–	–	–
Palau	–	–	–	–	–	–	–	–
Papua New Guinea	1 785	2 136	2 832	100	–	–	–	–
Pitcairn	–	–	–	–	–	–	–	–
Samoa	70	70	70	–	81	81	81	–
Solomon Islands	371	761	1 151	–	158	159	159	–
Tokelau	–	–	–	–	–	–	–	–
Tonga	2	2	1	58	50	50	45	67
Tuvalu	–	–	–	–	–	–	–	–
Vanuatu	45	39	32	–	28	89	105	–
Wallis and Futuna Islands	0	0	0	–	–	–	–	–
Oceania	–	–	–	–	–	–	–	–

TABLE 13 (continued)
Trends in removals of wood products 1990–2005

Country/area	Industrial roundwood				Woodfuel			
	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)	Total volume (1 000 m³ over bark)[a]			of which from forest 2005 (%)
	1990	2000	2005		1990	2000	2005	
Argentina	8 221	8 300	11 046	100	3 509	3 570	4 489	100
Bolivia (Plurinational State of)	–	581	871	–	–	34	38	–
Brazil	115 254	92 102	117 048	100	162 348	120 552	122 573	100
Chile	16 455	28 862	36 032	100	8 744	13 057	14 240	100
Colombia	4 021	2 541	2 106	–	7 798	10 772	11 225	–
Ecuador	3 673	2 200	1 306	–	3 577	5 844	5 027	–
Falkland Islands (Malvinas)*	–	–	–	–	–	–	–	–
French Guiana	91	60	62	100	0	0	0	–
Guyana	–	363	395	100	–	29	21	100
Paraguay	3 691	4 615	4 651	100	–	–	–	–
Peru	1 090	1 625	2 051	–	6 586	8 127	7 243	–
Suriname	116	177	181	100	n.s.	n.s.	2	100
Uruguay	849	1 530	3 243	–	3 086	2 389	1 863	–
Venezuela (Bolivarian Republic of)	–	1 034	1 321	18	–	24	6	–
South America	–	–	–	–	–	–	–	–
World	–	–	–	–	–	–	–	–

[a] Five year averages for 1988–1992, 1998-2002 and 2003–2007 respectively.
* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 14
Value of wood and NWFP removals 2005

Country/area	Value of removals (million US$)				Value per ha forest (US$)
	Industrial roundwood[a]	Woodfuel[a]	NWFP	Total	
Angola	–	–	–	–	–
Botswana	–	10	–	–	–
Comoros	2	2	–	–	–
Djibouti	–	–	–	–	–
Eritrea	n.s.	24	–	–	–
Ethiopia	–	–	–	–	–
Kenya	–	–	–	–	–
Lesotho	n.s.	8	–	–	–
Madagascar	5	8	–	–	–
Malawi	4	17	–	–	–
Mauritius	1	n.s.	25	26	1
Mayotte	–	–	–	–	–
Mozambique	261	–	–	–	–
Namibia	–	–	–	–	–
Réunion	n.s.	n.s.	–	–	–
Seychelles	–	–	–	–	–
Somalia	–	156	–	–	–
South Africa	763	167	–	–	n.s.
Swaziland	–	–	–	–	–
Uganda	–	–	–	–	–
United Republic of Tanzania	12	217	9	237	n.s.
Zambia	n.s.	n.s.	–	–	–
Zimbabwe	–	–	–	–	–
Eastern and Southern Africa	**–**	**–**	**–**	**–**	**–**
Algeria	2	n.s.	–	–	–
Egypt	5	5	1	11	n.s.
Libyan Arab Jamahiriya	–	–	–	–	–
Mauritania	–	2	–	–	–
Morocco	30	6	13	49	n.s.
Sudan[b]	–	–	–	–	–
Tunisia	5	n.s.	6	11	n.s.
Western Sahara	n.s.	–	–	–	–
Northern Africa	**–**	**–**	**–**	**–**	**–**
Benin	–	–	–	–	–
Burkina Faso	n.s.	63	–	–	–
Burundi	2	13	–	–	–
Cameroon	618	–	–	–	–
Cape Verde	–	1	–	–	–
Central African Republic	153	–	–	–	–
Chad	76	152	–	–	–
Congo	232	21	–	–	–
Côte d'Ivoire	299	–	–	–	–
Democratic Republic of the Congo	–	–	–	–	–
Equatorial Guinea	52	1	n.s.	53	n.s.
Gabon	194	–	–	–	–
Gambia	–	–	–	–	–
Ghana	53	–	–	–	–
Guinea	–	–	–	–	–
Guinea-Bissau	–	–	–	–	–
Liberia	–	–	–	–	–

TABLE 14 (continued)
Value of wood and NWFP removals 2005

Country/area	Value of removals (million US$)				Value per ha forest (US$)
	Industrial roundwood[a]	Woodfuel[a]	NWFP	Total	
Mali	n.s.	n.s.	–	–	–
Niger	3	57	–	–	–
Nigeria	124	456	–	–	–
Rwanda	3	27	–	–	–
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–
Sao Tome and Principe	–	–	–	–	–
Senegal	2	16	5	24	n.s.
Sierra Leone	–	–	–	–	–
Togo	–	–	–	–	–
Western and Central Africa	–	–	–	–	–
Africa	–	–	–	–	–
China	4 140	–	4 735	–	–
Democratic People's Republic of Korea	–	–	–	–	–
Japan	1 998	–	202	–	–
Mongolia	n.s.	n.s.	–	–	–
Republic of Korea	334	43	1 859	2 237	n.s.
East Asia	–	–	–	–	–
Bangladesh	–	–	–	–	–
Bhutan	5	n.s.	n.s.	5	n.s.
Brunei Darussalam	28	n.s.	–	–	–
Cambodia	–	–	–	–	–
India	6 253	7 095	133	13 481	n.s.
Indonesia	–	–	–	–	–
Lao People's Democratic Republic	18	–	5	–	–
Malaysia	2 706	–	43	–	–
Maldives	n.s.	–	–	–	–
Myanmar	765	812	–	–	–
Nepal	34	–	1	–	–
Pakistan	113	1 381	–	–	–
Philippines	119	2	2	123	n.s.
Singapore	–	–	–	–	–
Sri Lanka	46	39	–	–	–
Thailand	n.s.	n.s.	–	–	–
Timor-Leste	–	–	–	–	–
Viet Nam	473	116	n.s.	589	n.s.
South and Southeast Asia	–	–	–	–	–
Afghanistan	–	–	–	–	–
Armenia	1	1	–	–	–
Azerbaijan	–	–	–	–	–
Bahrain	–	–	–	–	–
Cyprus	1	n.s.	n.s.	1	n.s.
Georgia	–	–	–	–	–
Iran (Islamic Republic of)	114	n.s.	–	–	–
Iraq	–	–	–	–	–
Israel	2	n.s.	–	–	–
Jordan	–	n.s.	–	–	–
Kazakhstan	–	–	–	–	–
Kuwait	–	–	–	–	–
Kyrgyzstan	n.s.	n.s.	–	–	–

TABLE 14 (continued)
Value of wood and NWFP removals 2005

Country/area	Value of removals (million US$)				Value per ha forest (US$)
	Industrial roundwood[a]	Woodfuel[a]	NWFP	Total	
Lebanon	0	5	–	–	–
Occupied Palestinian Territory	–	–	–	–	–
Oman	–	–	–	–	–
Qatar	–	–	–	–	–
Saudi Arabia	–	8	–	–	–
Syrian Arab Republic	–	–	–	–	–
Tajikistan	–	n.s.	n.s.	–	–
Turkey	995	254	2	1 251	n.s.
Turkmenistan	0	n.s.	–	–	–
United Arab Emirates	–	–	–	–	–
Uzbekistan	1	n.s.	2	3	n.s.
Yemen	–	26	–	–	–
Western and Central Asia	–	–	–	–	–
Asia	–	–	–	–	–
Albania	1	n.s.	n.s.	1	n.s.
Andorra	–	–	–	–	–
Austria	1 233	297	144	1 674	n.s.
Belarus	–	–	–	–	–
Belgium	160	9	–	–	–
Bosnia and Herzegovina	–	–	–	–	–
Bulgaria	132	43	4	179	n.s.
Croatia	186	28	2	216	n.s.
Czech Republic	850	21	165	1 037	n.s.
Denmark	62	32	–	–	–
Estonia	215	26	–	–	–
Faroe Islands	–	–	–	–	–
Finland	2 632	88	133	2 853	n.s.
France	1 872	1 362	–	–	–
Germany	2 589	238	563	3 390	n.s.
Gibraltar	–	–	–	–	–
Greece	–	–	–	–	–
Guernsey	–	–	–	–	–
Holy See	–	–	–	–	–
Hungary	195	108	–	–	–
Iceland	n.s.	n.s.	n.s.	1	n.s.
Ireland	163	–	–	–	–
Isle of Man	–	–	–	–	–
Italy	209	335	329	873	n.s.
Jersey	–	–	–	–	–
Latvia	–	–	–	–	–
Liechtenstein	–	–	–	–	–
Lithuania	206	22	19	247	n.s.
Luxembourg	7	n.s.	–	–	–
Malta	–	–	–	–	–
Monaco	–	–	–	–	–
Montenegro	–	–	–	–	–
Netherlands	36	9	–	–	–
Norway	394	52	–	–	–
Poland	1 264	66	–	–	–
Portugal	383	15	420	818	n.s.

TABLE 14 (continued)
Value of wood and NWFP removals 2005

Country/area	Value of removals (million US$)				Value per ha forest (US$)
	Industrial roundwood[a]	Woodfuel[a]	NWFP	Total	
Republic of Moldova	–	–	–	–	–
Romania	–	–	14	–	–
Russian Federation	2 861	234	5 139	8 234	n.s.
San Marino	–	–	–	–	–
Serbia	68	53	37	158	n.s.
Slovakia	386	7	14	408	n.s.
Slovenia	108	21	12	142	n.s.
Spain	915	29	514	1 459	n.s.
Svalbard and Jan Mayen Islands	–	–	–	–	–
Sweden	2 933	273	120	3 326	n.s.
Switzerland	248	44	–	–	–
The former Yugoslav Republic of Macedonia	9	19	–	–	–
Ukraine	–	–	–	–	–
United Kingdom	367	9	111	487	n.s.
Europe	**–**	**–**	**–**	**–**	**–**
Anguilla	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–
Aruba	–	–	–	–	–
Bahamas	–	–	–	–	–
Barbados	–	–	–	–	–
Bermuda	–	–	–	–	–
British Virgin Islands	–	–	–	–	–
Cayman Islands	–	–	–	–	–
Cuba	108	16	1	125	n.s.
Dominica	–	–	–	–	–
Dominican Republic	–	–	–	–	–
Grenada	n.s.	–	–	–	–
Guadeloupe	n.s.	–	–	–	–
Haiti	–	–	–	–	–
Jamaica	n.s.	–	–	–	–
Martinique	n.s.	–	–	–	–
Montserrat	–	–	–	–	–
Netherlands Antilles	–	–	–	–	–
Puerto Rico	–	–	–	–	–
Saint Kitts and Nevis	–	–	–	–	–
Saint Lucia	–	–	–	–	–
Saint Martin (French part)	–	–	–	–	–
Saint Vincent and the Grenadines	–	–	–	–	–
Saint Barthélemy	–	–	–	–	–
Trinidad and Tobago	6	–	n.s.	–	–
Turks and Caicos Islands	–	–	–	–	–
United States Virgin Islands	–	–	–	–	–
Caribbean	**–**	**–**	**–**	**–**	**–**
Belize	–	–	–	–	–
Costa Rica	178	–	24	–	–
El Salvador	–	–	12	–	–
Guatemala	42	–	–	–	–
Honduras	–	–	n.s.	–	–
Nicaragua	17	n.s.	–	–	–
Panama	–	–	–	–	–
Central America	**–**	**–**	**–**	**–**	**–**

TABLE 14 (continued)
Value of wood and NWFP removals 2005

Country/area	Value of removals (million US$)				Value per ha forest (US$)
	Industrial roundwood[a]	Woodfuel[a]	NWFP	Total	
Canada	13 425	–	264	–	–
Greenland	–	–	–	–	–
Mexico	607	25	30	662	n.s.
Saint Pierre and Miquelon	–	–	–	–	–
United States of America	22 599	312	1 327	24 238	n.s.
North America	–	–	–	–	–
North and Central America	–	–	–	–	–
American Samoa	–	–	–	–	–
Australia	1 255	–	288	–	–
Cook Islands	–	–	–	–	–
Fiji	24	1	–	–	–
French Polynesia	n.s.	–	–	–	–
Guam	–	–	–	–	–
Kiribati	–	–	83	–	–
Marshall Islands	–	–	–	–	–
Micronesia (Federated States of)	–	–	–	–	–
Nauru	–	–	–	–	–
New Caledonia	1	–	–	–	–
New Zealand	1 447	–	28	–	–
Niue	–	–	–	–	–
Norfolk Island	–	–	–	–	–
Northern Mariana Islands	–	–	–	–	–
Palau	–	–	–	–	–
Papua New Guinea	9	–	–	–	–
Pitcairn	–	–	–	–	–
Samoa	–	–	–	–	–
Solomon Islands	–	–	–	–	–
Tokelau	–	–	–	–	–
Tonga	n.s.	2	–	–	–
Tuvalu	–	–	–	–	–
Vanuatu	–	–	–	–	–
Wallis and Futuna Islands	0	–	–	–	–
Oceania	–	–	–	–	–
Argentina	200	228	14	441	n.s.
Bolivia (Plurinational State of)	55	n.s.	–	–	–
Brazil	2 559	1 259	279	4 097	n.s.
Chile	1 320	238	47	1 606	n.s.
Colombia	n.s.	–	153	–	–
Ecuador	90	33	–	–	–
Falkland Islands (Malvinas)*	–	–	–	–	–
French Guiana	1	0	–	–	–
Guyana	99	–	n.s.	–	–
Paraguay	189	–	–	–	–
Peru	3	–	–	–	–
Suriname	17	n.s.	114	131	n.s.
Uruguay	2	–	–	–	–
Venezuela (Bolivarian Republic of)	121	–	–	–	–
South America	–	–	–	–	–
World	–	–	–	–	–

[a] Five year average for 2003–2007.
[b] Although data on value of wood removals were provided by Sudan it was not possible to convert the figures to US$ due to the highly fluctuating exchange rate.
* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 15
Employment in forestry 1990–2005 (1 000 FTE)

Country/area	Total			In primary production of goods			In management of protected areas		
	1990	2000	2005	1990	2000	2005	1990	2000	2005
Angola	–	–	–	1	–	–	–	–	–
Botswana	–	–	–	–	–	–	–	–	–
Comoros	–	–	–	–	–	–	–	–	–
Djibouti	–	–	–	–	–	–	–	–	–
Eritrea	–	–	–	–	–	–	–	–	–
Ethiopia	–	–	–	–	–	–	–	–	–
Kenya	–	–	–	2	2	2	–	–	–
Lesotho	–	–	–	n.s.	n.s.	2	–	–	–
Madagascar	–	–	–	–	48	–	–	–	–
Malawi	–	–	–	1	1	1	–	–	–
Mauritius	3	3	3	2	2	2	n.s.	1	1
Mayotte	n.s.	n.s.	n.s.	0	0	0	n.s.	n.s.	n.s.
Mozambique	–	–	–	–	–	–	–	–	–
Namibia	–	–	–	–	–	–	–	–	–
Réunion	–	1	1	–	n.s.	n.s.	–	1	1
Seychelles	–	–	–	–	–	–	–	–	–
Somalia	–	–	–	2	2	3	–	–	–
South Africa	–	–	–	–	66	121	–	–	–
Swaziland	–	–	–	–	–	–	–	–	–
Uganda	–	–	–	1	2	–	–	–	–
United Republic of Tanzania	–	–	–	4	4	3	–	–	–
Zambia	2	2	3	1	1	2	1	1	1
Zimbabwe	16	17	16	14	15	13	2	3	3
Eastern and Southern Africa	–	–	–	–	–	–	–	–	–
Algeria	49	50	97	48	49	96	1	1	1
Egypt	–	11	13	–	10	12	–	1	1
Libyan Arab Jamahiriya	–	–	–	–	–	–	–	–	–
Mauritania	–	–	–	–	–	–	–	–	–
Morocco	–	–	–	38	38	58	–	–	–
Sudan	–	–	–	–	–	–	–	–	–
Tunisia	–	–	–	32	42	38	–	–	–
Western Sahara	–	–	–	–	–	–	–	–	–
Northern Africa	–	–	–	–	–	–	–	–	–
Benin	–	–	–	–	–	–	–	n.s.	n.s.
Burkina Faso	–	–	–	–	2	–	–	–	–
Burundi	–	–	–	–	–	–	–	–	–
Cameroon	–	–	–	23	20	–	–	–	–
Cape Verde	–	–	–	–	–	n.s.	–	–	–
Central African Republic	4	5	7	3	4	6	1	1	1
Chad	–	1	1	–	1	1	n.s.	n.s.	n.s.
Congo	–	–	–	–	–	–	–	–	–
Côte d'Ivoire	–	–	–	–	34	–	–	–	–
Democratic Republic of the Congo	–	–	–	–	–	–	–	–	–
Equatorial Guinea	1	2	1	1	2	1	0	0	0
Gabon	–	–	10	–	7	10	–	–	n.s.
Gambia	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Ghana	–	–	–	3	2	3	–	–	–
Guinea	–	–	–	–	–	–	–	–	–
Guinea-Bissau	–	–	–	–	–	–	–	–	–
Liberia	–	4	2	5	4	2	–	n.s.	n.s.
Mali	137	137	137	135	135	135	2	2	2
Niger	–	8	8	2	8	8	–	n.s.	n.s.
Nigeria	11	11	12	9	10	10	1	1	2

TABLE 15 (continued)
Employment in forestry 1990–2005 (1 000 FTE)

Country/area	Total			In primary production of goods			In management of protected areas		
	1990	2000	2005	1990	2000	2005	1990	2000	2005
Rwanda	–	–	1	–	–	n.s.	–	–	n.s.
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–	–	–	–
Sao Tome and Principe	–	–	–	–	–	–	–	–	–
Senegal	9	13	14	9	12	14	n.s.	n.s.	n.s.
Sierra Leone	–	n.s.	n.s.	–	n.s.	n.s.	–	n.s.	n.s.
Togo	–	–	–	–	–	–	–	–	–
Western and Central Africa	–	–	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–	–	–
China	1 870	1 521	1 322	1 863	1 462	1 203	7	59	120
Democratic People's Republic of Korea	–	–	–	–	–	–	–	–	–
Japan	–	–	–	108	67	47	–	–	–
Mongolia	–	–	–	–	–	–	–	–	–
Republic of Korea	–	–	–	–	12	24	–	–	–
East Asia	–	–	–	–	–	–	–	–	–
Bangladesh	–	–	–	78	93	93	–	–	–
Bhutan	–	–	–	1	3	5	–	–	–
Brunei Darussalam	–	–	–	–	–	–	–	–	–
Cambodia	–	–	–	19	16	16	–	–	–
India	6 385	6 078	6 213	6 360	6 053	6 188	25	25	25
Indonesia	–	42	20	–	39	17	–	3	3
Lao People's Democratic Republic	–	–	–	–	–	–	–	–	–
Malaysia	78	68	127	76	66	125	2	2	2
Maldives	–	–	–	–	–	–	–	–	–
Myanmar	–	–	–	–	–	–	n.s.	n.s.	–
Nepal	145	111	115	138	96	105	7	14	10
Pakistan	33	30	–	30	27	–	3	3	–
Philippines	18	19	24	18	18	23	1	1	1
Singapore	n.s.	n.s.	n.s.	0	0	0	n.s.	n.s.	n.s.
Sri Lanka	3	5	5	2	5	5	n.s.	1	1
Thailand	–	–	–	–	–	–	–	–	–
Timor-Leste	–	–	–	–	–	–	–	–	–
Viet Nam	–	–	246	80	198	239	–	–	7
South and Southeast Asia	–	–	–	–	–	–	–	–	–
Afghanistan	–	–	–	–	–	–	–	–	–
Armenia	–	3	2	5	2	2	–	1	n.s.
Azerbaijan	–	–	–	5	4	2	–	–	–
Bahrain	–	–	–	–	–	–	–	–	–
Cyprus	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Georgia	–	–	–	12	4	3	–	–	–
Iran (Islamic Republic of)	–	–	–	63	86	–	–	–	–
Iraq	–	–	–	–	–	–	–	–	–
Israel	–	–	–	4	3	1	–	–	–
Jordan	–	–	–	n.s.	1	1	–	–	–
Kazakhstan	–	–	16	14	14	14	–	–	3
Kuwait	–	–	–	–	–	–	–	–	–
Kyrgyzstan	–	5	3	3	4	3	–	n.s.	n.s.
Lebanon	–	–	7	–	–	2	–	–	5
Occupied Palestinian Territory	–	–	–	–	–	–	–	–	–
Oman	–	–	–	–	–	–	–	–	–
Qatar	–	–	–	–	–	–	–	–	–
Saudi Arabia	1	1	1	1	1	1	n.s.	n.s.	n.s.

TABLE 15 (continued)
Employment in forestry 1990–2005 (1 000 FTE)

Country/area	Total			In primary production of goods			In management of protected areas		
	1990	2000	2005	1990	2000	2005	1990	2000	2005
Syrian Arab Republic	–	2	2	–	1	2	–	n.s.	n.s.
Tajikistan	4	5	6	4	5	6	n.s.	n.s.	n.s.
Turkey	101	48	43	101	48	42	n.s.	1	1
Turkmenistan	–	–	–	2	2	2	–	–	–
United Arab Emirates	–	–	–	–	–	–	–	–	–
Uzbekistan	5	7	7	4	6	6	1	1	1
Yemen	–	–	–	–	–	–	–	–	–
Western and Central Asia	–	–	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–	–	–
Albania	–	–	–	2	n.s.	n.s.	–	–	–
Andorra	–	–	–	–	–	–	–	–	–
Austria	–	–	–	31	19	18	–	–	–
Belarus	–	34	35	22	33	33	–	1	1
Belgium	–	–	3	4	3	3	–	–	n.s.
Bosnia and Herzegovina	–	–	–	–	–	–	–	–	–
Bulgaria	–	110	119	–	26	21	–	84	98
Croatia	–	–	–	14	10	9	–	–	–
Czech Republic	–	–	–	53	31	22	–	–	–
Denmark	4	4	4	4	4	4	n.s.	n.s.	n.s.
Estonia	10	10	6	10	10	6	n.s.	n.s.	n.s.
Faroe Islands	–	–	–	–	–	–	–	–	–
Finland	39	24	23	39	24	23	n.s.	n.s.	n.s.
France	–	–	–	53	38	31	–	–	–
Germany	–	–	–	–	–	49	–	–	–
Gibraltar	–	–	–	–	–	–	–	–	–
Greece	–	–	–	–	–	–	–	–	–
Guernsey	–	–	–	–	–	–	–	–	–
Holy See	–	–	–	–	–	–	–	–	–
Hungary	38	37	36	37	32	31	1	5	5
Iceland	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	0	0	0
Ireland	–	–	–	–	–	–	–	–	–
Isle of Man	–	–	–	–	–	–	–	–	–
Italy	–	–	47	56	36	41	–	–	6
Jersey	–	–	–	–	–	–	–	–	–
Latvia	–	–	35	15	19	35	–	–	n.s.
Liechtenstein	–	–	–	–	–	–	–	–	–
Lithuania	–	–	10	15	14	10	–	–	n.s.
Luxembourg	–	–	–	–	–	–	–	–	–
Malta	–	–	–	–	–	–	–	–	–
Monaco	–	–	–	–	–	–	–	–	–
Montenegro	–	–	–	3	2	1	–	–	–
Netherlands	–	–	–	–	–	–	–	–	–
Norway	–	8	7	–	8	7	–	n.s.	n.s.
Poland	132	–	–	131	60	48	1	–	–
Portugal	–	–	–	16	11	8	–	–	–
Republic of Moldova	–	–	–	5	3	4	–	–	–
Romania	79	71	60	79	71	60	0	0	n.s.
Russian Federation	–	–	448	900	474	444	–	–	4
San Marino	–	–	–	–	–	–	–	–	–
Serbia	–	–	7	12	8	7	–	–	1
Slovakia	–	25	24	36	25	24	–	n.s.	n.s.
Slovenia	–	–	–	6	6	7	–	–	–

TABLE 15 (continued)
Employment in forestry 1990–2005 (1 000 FTE)

Country/area	Total			In primary production of goods			In management of protected areas		
	1990	2000	2005	1990	2000	2005	1990	2000	2005
Spain	–	–	36	–	35	31	–	–	5
Svalbard and Jan Mayen Islands	–	–	–	–	–	–	–	–	–
Sweden	–	–	–	34	17	20	–	–	–
Switzerland	–	–	–	8	6	5	–	–	–
The former Yugoslav Republic of Macedonia	4	3	3	4	3	3	n.s.	n.s.	n.s.
Ukraine	64	108	102	62	105	98	2	3	4
United Kingdom	20	11	10	18	9	8	2	2	2
Europe	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Anguilla	–	–	–	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	–	–	–	–
Bahamas	–	–	–	–	–	–	–	–	–
Barbados	–	–	–	–	–	n.s.	–	–	–
Bermuda	–	–	–	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–	–	–	–
Cuba	–	–	45	–	–	38	–	–	7
Dominica	–	–	–	–	–	–	–	–	–
Dominican Republic	–	–	–	–	–	–	–	–	–
Grenada	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Guadeloupe	–	–	n.s.	–	–	n.s.	–	–	n.s.
Haiti	–	–	–	–	–	–	–	–	–
Jamaica	4	1	1	4	1	1	n.s.	n.s.	n.s.
Martinique	–	–	n.s.	–	–	n.s.	–	–	n.s.
Montserrat	–	–	–	–	–	–	–	–	–
Netherlands Antilles	–	–	–	–	–	–	–	–	–
Puerto Rico	–	–	–	–	–	–	–	–	–
Saint Kitts and Nevis	–	–	–	–	–	–	–	–	–
Saint Lucia	–	–	–	–	–	–	–	–	–
Saint Martin (French part)	–	–	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	–	–	–	–	–	–	–	–
Saint Barthélemy	–	–	–	–	–	–	–	–	–
Trinidad and Tobago	–	–	–	1	1	1	–	–	–
Turks and Caicos Islands	–	–	–	–	–	–	–	–	–
United States Virgin Islands	–	–	–	–	–	–	–	–	–
Caribbean	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Belize	–	–	–	–	–	–	–	–	–
Costa Rica	–	–	–	–	7	5	–	–	–
El Salvador	8	8	9	7	8	9	n.s.	n.s.	n.s.
Guatemala	–	–	–	–	–	39	–	–	–
Honduras	–	–	–	18	26	33	–	–	–
Nicaragua	–	–	–	15	30	35	–	–	–
Panama	–	–	–	–	–	–	–	–	–
Central America	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Canada	–	–	–	73	87	70	–	–	–
Greenland	–	–	–	–	–	–	–	–	–
Mexico	–	–	–	–	–	–	–	–	–
Saint Pierre and Miquelon	0	0	0	0	0	0	0	0	0
United States of America	–	–	169	–	164	160	–	–	9
North America	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
North and Central America	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**

TABLE 15 (continued)
Employment in forestry 1990–2005 (1 000 FTE)

Country/area	Total			In primary production of goods			In management of protected areas		
	1990	2000	2005	1990	2000	2005	1990	2000	2005
American Samoa	–	–	–	–	–	–	–	–	–
Australia	–	–	–	11	14	11	–	–	–
Cook Islands	–	–	–	–	–	–	–	–	–
Fiji	–	–	–	–	–	–	–	–	–
French Polynesia	–	–	–	–	–	–	–	–	–
Guam	–	–	–	–	–	–	–	–	–
Kiribati	–	–	–	–	–	–	–	–	–
Marshall Islands	–	–	–	–	–	–	–	–	–
Micronesia (Federated States of)	–	–	–	–	–	–	–	–	–
Nauru	–	–	–	–	–	–	–	–	–
New Caledonia	–	–	–	–	n.s.	n.s.	–	–	–
New Zealand	7	8	9	6	7	8	1	1	2
Niue	–	–	–	–	–	–	–	–	–
Norfolk Island	–	–	–	–	–	–	–	–	–
Northern Mariana Islands	–	–	–	–	–	–	–	–	–
Palau	–	–	–	–	–	–	–	–	–
Papua New Guinea	–	–	–	–	–	–	–	–	–
Pitcairn	–	–	–	–	–	–	–	–	–
Samoa	–	–	–	–	–	–	–	–	–
Solomon Islands	–	–	–	–	–	–	–	–	–
Tokelau	–	–	–	–	–	–	–	–	–
Tonga	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Tuvalu	–	–	–	–	–	–	–	–	–
Vanuatu	–	–	–	–	–	–	–	–	–
Wallis and Futuna Islands	–	–	n.s.	–	–	n.s.	0	0	0
Oceania	–	–	–	–	–	–	–	–	–
Argentina	–	32	–	–	32	–	1	1	1
Bolivia (Plurinational State of)	–	–	–	–	14	14	–	–	–
Brazil	–	66	109	–	65	108	–	1	1
Chile	–	–	–	–	–	–	–	–	–
Colombia	–	–	–	–	–	–	–	–	–
Ecuador	–	23	23	–	23	23	–	n.s.	n.s.
Falkland Islands (Malvinas)*	–	–	–	–	–	–	–	–	–
French Guiana	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
Guyana	–	–	–	–	–	24	–	–	–
Paraguay	–	–	–	5	4	4	–	–	–
Peru	–	–	13	–	10	12	–	–	n.s.
Suriname	3	3	5	2	3	5	1	n.s.	n.s.
Uruguay	–	–	–	1	6	5	–	–	–
Venezuela (Bolivarian Republic of)	–	–	–	–	2	–	–	–	–
South America	–	–	–	–	–	–	–	–	–
World	–	–	–	–	–	–	–	–	–

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 16
Forest policy and legal framework 2008

Country/area	Policy			National forest programme			Forest law		
	National		Sub-national				National		Sub-national
	Exists	Year	Exists	Exists	Year	Status	Type	Year	Exists
Angola	No	–	Yes	Yes	–	In formulation	Specific forest law	1955	Yes
Botswana	No	–	No	No	–	–	Specific forest law	1968	No
Comoros	–	–	–	–	–	–	–	–	–
Djibouti	–	–	–	–	–	–	–	–	–
Eritrea	No	–	No	Yes	2008	In implementation	Specific forest law	2006	No
Ethiopia	Yes	2007	Yes	Yes	2008	In formulation	No national forest law	–	No
Kenya	Yes	2006	No	Yes	2007	Temporarily suspended	Specific forest law	2005	No
Lesotho	Yes	2008	No	Yes	2009	Temporarily suspended	Specific forest law	1998	Yes
Madagascar	Yes	1997	No	No	–	–	Specific forest law	1997	No
Malawi	Yes	1996	No	Yes	2001	In implementation	Specific forest law	1997	No
Mauritius	Yes	2006	No	Yes	2006	In formulation	Specific forest law	1983	No
Mayotte	No	–	Yes	No	–	–	No national forest law	–	Yes
Mozambique	Yes	1999	–	Yes	1998	Under revision	Specific forest law	1999	–
Namibia	Yes	1996	Yes	No	–	–	Specific forest law	2001	Yes
Réunion	Yes	2007	No	Yes	2006	In implementation	Specific forest law	2001	No
Seychelles	Yes	2000	–	No	–	–	Specific forest law	1955	–
Somalia	–	–	–	–	–	–	–	–	–
South Africa	Yes	1996	No	Yes	1997	Under revision	Specific forest law	1998	No
Swaziland	Yes	2002	No	Yes	2002	Temporarily suspended	Incorporated in other law	2002	No
Uganda	Yes	2001	No	Yes	2002	In implementation	Specific forest law	2003	No
United Republic of Tanzania	Yes	1998	No	Yes	–	In implementation	Specific forest law	2002	No
Zambia	Yes	1998	No	Yes	1996	Temporarily suspended	Specific forest law	1973	No
Zimbabwe	No	–	No	Yes	–	In formulation	Specific forest law	1949	No
Eastern and Southern Africa	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Algeria	No	–	No	No	–	–	Specific forest law	1984	No
Egypt	No	–	No	–	2000	In implementation	Incorporated in other law	–	No
Libyan Arab Jamahiriya	–	–	–	–	–	–	–	–	–
Mauritania	Yes	2001	No	No	–	–	Specific forest law	2007	No
Morocco	Yes	2006	No	Yes	1999	In implementation	Specific forest law	1917	No
Sudan	Yes	2005	Yes	Yes	1986	In implementation	Specific forest law	2002	Yes
Tunisia	Yes	1988	No	Yes	1988	In implementation	Specific forest law	1966	No
Western Sahara	–	–	–	–	–	–	–	–	–
Northern Africa	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Benin	Yes	1994	No	Yes	2007	In implementation	Specific forest law	1993	No
Burkina Faso	Yes	1995	Yes	Yes	2006	In implementation	Specific forest law	1997	Yes
Burundi	Yes	2006	No	Yes	–	In implementation	Specific forest law	1985	No
Cameroon	Yes	1993	No	Yes	2005	In implementation	Specific forest law	1994	No
Cape Verde	–	–	–	–	–	–	–	–	–
Central African Republic	Yes	2003	No	Yes	1994	Temporarily suspended	Specific forest law	2008	No
Chad	Yes	2000	No	Yes	1972	In implementation	Incorporated in other law	2008	No
Congo	Yes	2002	No	Yes	–	In formulation	Specific forest law	2000	No
Côte d'Ivoire	Yes	1988	–	–	–	–	Specific forest law	1965	–
Democratic Republic of the Congo	No	–	No	Yes	2009	In implementation	Specific forest law	2002	No
Equatorial Guinea	Yes	1997	No	Yes	2000	In formulation	–	1997	No
Gabon	Yes	2004	–	Yes	1993	Temporarily suspended	Specific forest law	2001	–
Gambia	Yes	1995	No	Yes	2000	Under revision	Specific forest law	1998	No
Ghana	Yes	1994	–	Yes	1993	Under revision	Specific forest law	1998	–
Guinea	Yes	1991	No	Yes	1989	In implementation	Specific forest law	1989	No
Guinea-Bissau	Yes	1992	No	Yes	1992	Under revision	Specific forest law	1991	No
Liberia	Yes	2006	No	Yes	2008	In implementation	Specific forest law	1976	No
Mali	No	–	No	Yes	2002	In implementation	Specific forest law	1995	No

TABLE 16 (continued)
Forest policy and legal framework 2008

Country/area	Policy			National forest programme			Forest law		
	National		Sub-national				National		Sub-national
	Exists	Year	Exists	Exists	Year	Status	Type	Year	Exists
Niger	No	–	No	Yes	–	In formulation	Specific forest law	2004	No
Nigeria	Yes	2006	No	Yes	2002	Under revision	No national forest law	–	Yes
Rwanda	Yes	2004	No	–	–	–	Specific forest law	1988	No
Saint Helena, Ascension and Tristan da Cunha	Yes	2006	No	Yes	2007	In implementation	Specific forest law	1954	No
Sao Tome and Principe	–	–	–	–	–	–	–	–	–
Senegal	Yes	2005	No	Yes	1992	In implementation	Specific forest law	1998	No
Sierra Leone	Yes	2004	No	No	–	–	Specific forest law	1988	No
Togo	Yes	1998	–	Yes	–	–	Specific forest law	2008	–
Western and Central Africa	–	–	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–	–	–
China	Yes	2008	No	Yes	2006	In implementation	Specific forest law	1979	Yes
Democratic People's Republic of Korea	–	–	–	–	–	–	–	–	–
Japan	Yes	2001	Yes	Yes	2006	In implementation	Specific forest law	1951	No
Mongolia	No	–	No	Yes	2002	In implementation	Specific forest law	2007	Yes
Republic of Korea	Yes	1972	No	Yes	2008	In implementation	Specific forest law	1961	No
East Asia	–	–	–	–	–	–	–	–	–
Bangladesh	Yes	1994	No	Yes	1995	In implementation	Specific forest law	1927	No
Bhutan	Yes	1974	No	Yes	2008	In implementation	Specific forest law	1995	No
Brunei Darussalam	Yes	1989	No	Yes	–	In implementation	Specific forest law	1934	No
Cambodia	Yes	2002	No	Yes	2007	In formulation	Specific forest law	2002	No
India	Yes	1988	Yes	Yes	1999	In implementation	Specific forest law	1927	Yes
Indonesia	Yes	2006	No	Yes	2000	In implementation	Specific forest law	1999	No
Lao People's Democratic Republic	Yes	1991	–	Yes	2005	–	Specific forest law	2006	–
Malaysia	Yes	1992	Yes	Yes	2006	In implementation	Specific forest law	1984	Yes
Maldives	No	–	No	No	–	–	Incorporated in other law	1998	No
Myanmar	Yes	–	–	Yes	2001	In implementation	Specific forest law	1902	–
Nepal	Yes	1989	No	Yes	–	In implementation	Specific forest law	1993	No
Pakistan	Yes	1955	Yes	Yes	–	In implementation	No national forest law	–	Yes
Philippines	Yes	1995	No	Yes	2003	In implementation	Specific forest law	1975	No
Singapore	No	–	No	No	–	–	Incorporated in other law	2005	No
Sri Lanka	Yes	1995	No	Yes	–	–	Specific forest law	1907	No
Thailand	Yes	2007	–	Yes	1985	In implementation	Specific forest law	1941	–
Timor-Leste	Yes	2007	No	No	–	–	Specific forest law	2000	No
Viet Nam	Yes	2003	No	Yes	1987	In implementation	Specific forest law	1992	No
South and Southeast Asia	–	–	–	–	–	–	–	–	–
Afghanistan	Yes	2005	No	No	–	–	Specific forest law	–	No
Armenia	Yes	2005	No	Yes	–	In implementation	Specific forest law	2005	No
Azerbaijan	No	–	No	No	–	–	Specific forest law	1998	No
Bahrain	–	–	–	–	–	–	–	–	–
Cyprus	Yes	2002	No	Yes	2000	In implementation	Specific forest law	1967	No
Georgia	No	–	No	Yes	2006	In formulation	Specific forest law	1999	No
Iran (Islamic Republic of)	–	–	–	Yes	1996	In implementation	Specific forest law	1967	–
Iraq	–	–	–	–	–	–	–	–	–
Israel	Yes	2006	No	No	1995	Under revision	Specific forest law	1926	No
Jordan	No	–	No	No	–	–	Incorporated in other law	1923	No
Kazakhstan	Yes	–	No	Yes	2004	–	Specific forest law	2003	No
Kuwait	–	–	–	–	–	–	–	–	–
Kyrgyzstan	Yes	2004	No	Yes	2005	In implementation	Specific forest law	1999	No
Lebanon	No	–	No	No	–	–	Specific forest law	1949	No

TABLE 16 (continued)
Forest policy and legal framework 2008

Country/area	Policy			National forest programme			Forest law		
	National		Sub-national				National		Sub-national
	Exists	Year	Exists	Exists	Year	Status	Type	Year	Exists
Occupied Palestinian Territory	–	–	–	–	–	–	–	–	–
Oman	Yes	2003	No	No	–	–	Specific forest law	2003	No
Qatar	–	–	–	–	–	–	–	–	–
Saudi Arabia	Yes	2005	No	Yes	2006	In implementation	Specific forest law	2004	No
Syrian Arab Republic	No	–	No	Yes	1953	In implementation	Specific forest law	1953	No
Tajikistan	Yes	2000	No	Yes	2008	In formulation	Specific forest law	1993	No
Turkey	Yes	2005	No	Yes	2004	In implementation	Specific forest law	1956	No
Turkmenistan	Yes	–	–	No	–	–	Specific forest law	–	–
United Arab Emirates	No	–	No	No	–	–	No national forest law	–	No
Uzbekistan	No	–	–	Yes	2006	In formulation	Specific forest law	1999	–
Yemen	No	–	No	No	–	–	No national forest law	–	No
Western and Central Asia	–	–	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–	–	–
Albania	Yes	2005	No	No	–	–	Specific forest law	2005	No
Andorra	–	–	–	–	–	–	–	–	–
Austria	Yes	2006	Yes	Yes	2003	In implementation	Specific forest law	1975	Yes
Belarus	Yes	1996	No	Yes	2007	In implementation	Specific forest law	2000	No
Belgium	No	–	Yes	No	–	–	No national forest law	–	Yes
Bosnia and Herzegovina	–	–	–	–	–	–	–	–	–
Bulgaria	Yes	2006	No	Yes	2003	In implementation	Specific forest law	1958	No
Croatia	No	–	No	Yes	2003	Under revision	Specific forest law	2005	No
Czech Republic	Yes	1994	No	Yes	2008	In implementation	Specific forest law	1995	No
Denmark	Yes	2002	No	Yes	2002	In formulation	Specific forest law	2004	No
Estonia	Yes	1997	No	Yes	2002	Under revision	Specific forest law	2007	No
Faroe Islands	–	–	–	–	–	–	–	–	–
Finland	Yes	2008	Yes	Yes	2008	In implementation	Specific forest law	1996	Yes
France	Yes	2007	No	Yes	2006	In implementation	Specific forest law	2001	No
Germany	Yes	2009	Yes	Yes	1999	Under revision	Specific forest law	1975	Yes
Gibraltar	–	–	–	–	–	–	–	–	–
Greece	–	–	–	–	–	–	–	–	–
Guernsey	No	–	No	No	–	–	No national forest law	–	No
Holy See	–	–	–	–	–	–	–	–	–
Hungary	No	–	No	Yes	2006	In implementation	Specific forest law	2009	No
Iceland	No	–	Yes	No	–	–	Specific forest law	1955	No
Ireland	Yes	1996	No	Yes	1996	In implementation	Specific forest law	1946	No
Isle of Man	Yes	2000	No	No	–	–	Specific forest law	1984	No
Italy	Yes	2001	Yes	Yes	2009	In implementation	Specific forest law	2001	Yes
Jersey	No	–	No	No	–	–	No national forest law	–	No
Latvia	Yes	1998	No	Yes	2006	In formulation	Specific forest law	2000	No
Liechtenstein	–	–	–	–	–	–	–	–	–
Lithuania	Yes	2002	No	Yes	1996	In implementation	Specific forest law	1994	No
Luxembourg	No	–	No	Yes	2004	In implementation	Incorporated in other law	–	No
Malta	–	–	–	–	–	–	–	–	–
Monaco	–	–	–	–	–	–	–	–	–
Montenegro	–	–	–	–	–	–	–	–	–
Netherlands	Yes	2001	Yes	Yes	2005	In formulation	Specific forest law	1962	No
Norway	Yes	1998	Yes	Yes	1998	In implementation	Specific forest law	2005	No
Poland	Yes	1997	No	Yes	2000	In formulation	Specific forest law	1991	No
Portugal	Yes	2006	No	Yes	1996	In implementation	Incorporated in other law	1996	Yes
Republic of Moldova	Yes	2001	No	–	–	–	Specific forest law	1996	No

TABLE 16 (continued)
Forest policy and legal framework 2008

Country/area	Policy			National forest programme			Forest law		
	National		Sub-national				National		Sub-national
	Exists	Year	Exists	Exists	Year	Status	Type	Year	Exists
Romania	Yes	2005	No	Yes	2000	In implementation	Specific forest law	2008	No
Russian Federation	No	–	No	Yes	2003	In implementation	Specific forest law	2006	No
San Marino	–	–	–	–	–	–	–	–	–
Serbia	Yes	2006	No	Yes	2005	In formulation	Specific forest law	1991	No
Slovakia	Yes	2006	No	Yes	2007	In implementation	Specific forest law	2005	No
Slovenia	Yes	1996	No	Yes	2007	In implementation	Specific forest law	1993	No
Spain	Yes	1999	Yes	Yes	2002	Under revision	Specific forest law	2003	Yes
Svalbard and Jan Mayen Islands	–	–	–	–	–	–	–	–	–
Sweden	Yes	1993	No	Yes	2002	In implementation	Specific forest law	1979	No
Switzerland	No	–	No	Yes	2004	In implementation	Specific forest law	1991	Yes
The former Yugoslav Republic of Macedonia	Yes	2006	–	Yes	2006	In implementation	Specific forest law	2009	–
Ukraine	No	–	No	Yes	2010	In implementation	Specific forest law	1994	No
United Kingdom	No	–	Yes	Yes	2003	Under revision	Specific forest law	1967	No
Europe	–	–	–	–	–	–	–	–	–
Anguilla	–	–	–	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	–	–	–	–
Bahamas	–	–	–	–	–	–	–	–	–
Barbados	No	–	No	No	–	–	Incorporated in other law	–	–
Bermuda	–	–	–	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–	–	–	–
Cayman Islands	No	–	No	No	–	–	No national forest law	–	No
Cuba	Yes	1977	No	Yes	2006	In implementation	Specific forest law	1998	No
Dominica	Yes	1949	No	No	–	–	Specific forest law	1976	No
Dominican Republic	Yes	2001	No	No	–	–	Incorporated in other law	2000	No
Grenada	Yes	–	No	Yes	–	In implementation	Specific forest law	1906	No
Guadeloupe	Yes	2007	No	Yes	2006	In implementation	Specific forest law	2001	No
Haiti	No	–	No	Yes	–	In formulation	Specific forest law	1926	No
Jamaica	Yes	2001	No	Yes	2001	Under revision	Specific forest law	1996	No
Martinique	Yes	2007	No	Yes	2006	In implementation	Specific forest law	2001	No
Montserrat	Yes	1993	No	Yes	1992	Under revision	Specific forest law	1996	No
Netherlands Antilles	–	–	–	–	–	–	–	–	–
Puerto Rico	–	–	–	–	–	–	–	–	–
Saint Kitts and Nevis	–	–	No	–	–	–	Incorporated in other law	1987	No
Saint Lucia	Yes	2008	No	Yes	1992	Under revision	Specific forest law	1946	No
Saint Martin (French part)	–	–	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	–	–	–	–	–	–	–	–
Saint-Barthélemy	–	–	–	–	–	–	–	–	–
Trinidad and Tobago	Yes	2008	No	No	–	–	Specific forest law	1918	No
Turks and Caicos Islands	No	–	No	No	–	–	No national forest law	–	No
United States Virgin Islands	–	–	–	–	–	–	–	–	–
Caribbean	–	–	–	–	–	–	–	–	–
Belize	–	–	–	–	–	–	–	–	–
Costa Rica	Yes	2000	No	Yes	2001	Under revision	Specific forest law	1996	No
El Salvador	Yes	2000	No	Yes	2003	In implementation	Specific forest law	2002	No
Guatemala	Yes	1999	No	Yes	2003	In implementation	Specific forest law	1996	No
Honduras	Yes	1971	No	Yes	2004	In implementation	Specific forest law	–	No
Nicaragua	Yes	2008	No	Yes	2008	In implementation	Specific forest law	2003	Yes
Panama	Yes	2003	No	Yes	2008	–	Specific forest law	1994	No
Central America	–	–	–	–	–	–	–	–	–

TABLE 16 (continued)
Forest policy and legal framework 2008

Country/area	Policy			National forest programme			Forest law		
	National		Sub-national				National		Sub-national
	Exists	Year	Exists	Exists	Year	Status	Type	Year	Exists
Canada	Yes	2008	Yes	No	–	–	No national forest law	–	Yes
Greenland	–	–	–	–	–	–	–	–	–
Mexico	Yes	2001	Yes	Yes	2007	In implementation	Specific forest law	2003	Yes
Saint Pierre and Miquelon	Yes	2007	No	No	–	–	Incorporated in other law	2000	No
United States of America	Yes	1969	Yes	No	–	–	Specific forest law	–	Yes
North America	–	–	–	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–	–	–	–
American Samoa	–	–	–	–	–	–	–	–	–
Australia	Yes	1992	Yes	Yes	–	In implementation	Incorporated in other law	–	Yes
Cook Islands	Yes	1997	Yes	Yes	1997	Temporarily suspended	Incorporated in other law	–	Yes
Fiji	Yes	2007	No	No	–	In formulation	Specific forest law	1992	No
French Polynesia	No	–	No	No	–	–	Specific forest law	1958	No
Guam	–	–	–	–	–	–	–	–	–
Kiribati	Yes	2011	Yes	No	–	In formulation	Incorporated in other law	1999	No
Marshall Islands	–	–	–	–	–	–	–	–	–
Micronesia (Federated States of)	–	–	–	–	–	–	–	–	–
Nauru	–	–	–	–	–	–	–	–	–
New Caledonia	No	–	No	No	–	–	Incorporated in other law	1910	Yes
New Zealand	Yes	1990	No	No	–	–	Specific forest law	1993	No
Niue	Yes	2000	No	Yes	–	In formulation	Specific forest law	2004	No
Norfolk Island	–	–	–	–	–	–	–	–	–
Northern Mariana Islands	–	–	–	–	–	–	–	–	–
Palau	No	–	Yes	No	–	–	No national forest law	–	Yes
Papua New Guinea	Yes	1991	No	No	–	–	Specific forest law	1991	No
Pitcairn	–	–	–	–	–	–	–	–	–
Samoa	–	–	–	–	–	–	–	–	–
Solomon Islands	Yes	2008	No	Yes	–	In implementation	Specific forest law	–	Yes
Tokelau	–	–	–	–	–	–	–	–	–
Tonga	Yes	2008	No	Yes	2005	Under revision	Specific forest law	1961	No
Tuvalu	–	–	–	–	–	–	–	–	–
Vanuatu	Yes	1997	Yes	Yes	1996	–	Specific forest law	1985	Yes
Wallis and Futuna Islands	No	–	No	No	–	–	No national forest law	–	No
Oceania	–	–	–	–	–	–	–	–	–
Argentina	No	–	No	No	–	–	Specific forest law	2007	Yes
Bolivia (Plurinational State of)	Yes	2008	No	Yes	2008	In implementation	Specific forest law	1996	No
Brazil	No	–	Yes	Yes	2000	In implementation	Specific forest law	1965	Yes
Chile	No	–	No	No	–	–	Specific forest law	1974	No
Colombia	Yes	1996	No	Yes	2000	Under revision	Incorporated in other law	1974	No
Ecuador	Yes	2002	No	Yes	2002	In implementation	Specific forest law	1981	No
Falkland Islands (Malvinas)*	No	–	No	No	–	–	No national forest law	–	No
French Guiana	Yes	2007	Yes	Yes	2006	In implementation	Specific forest law	2001	Yes
Guyana	Yes	1997	No	Yes	2001	In implementation	Specific forest law	1953	No
Paraguay	No	–	No	Yes	1999	In implementation	Specific forest law	1973	No
Peru	No	–	Yes	Yes	2004	In implementation	Specific forest law	2000	No
Suriname	Yes	2003	No	Yes	2006	In formulation	Specific forest law	1992	No
Uruguay	Yes	1987	No	Yes	–	–	Specific forest law	1987	No
Venezuela (Bolivarian Republic of)	Yes	1999	No	No	–	–	Specific forest law	2008	No
South America	–	–	–	–	–	–	–	–	–
World	–	–	–	–	–	–	–	–	–

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 17
Human resources within public forest institutions 2000–2008

Country/area	2000		2005		2008	
	Number	% Female	Number	% Female	Number	% Female
Angola	1 308	18	1 071	14	1 030	15
Botswana	–	–	637	21	629	22
Comoros	–	–	–	–	–	–
Djibouti	–	–	–	–	–	–
Eritrea	38	9	40	23	45	18
Ethiopia	–	–	–	–	675	–
Kenya	–	–	–	–	5 351	20
Lesotho	–	–	80	10	115	8
Madagascar	1 100	–	1 100	–	1 100	–
Malawi	3 308	28	5 591	16	6 651	15
Mauritius	225	3	197	4	213	6
Mayotte	–	–	–	–	–	–
Mozambique	88	–	96	–	128	–
Namibia	–	–	600	–	500	–
Réunion	–	–	65	20	76	18
Seychelles	174	–	118	–	86	–
Somalia	–	–	–	–	–	–
South Africa	10 000	–	3 749	–	3 095	45
Swaziland	20	10	13	15	14	14
Uganda	–	–	–	–	–	–
United Republic of Tanzania	1 653	5	1 653	10	1 653	15
Zambia	878	37	878	37	908	40
Zimbabwe	369	–	557	–	550	–
Eastern and Southern Africa	–	–	–	–	–	–
Algeria	8 400	14	8 662	16	8 655	17
Egypt	5 000	30	5 700	32	6 500	34
Libyan Arab Jamahiriya	–	–	–	–	–	–
Mauritania	–	–	–	–	160	6
Morocco	–	–	5 300	12	5 757	13
Sudan	4 876	–	2 988	21	3 100	24
Tunisia	509	1	456	1	415	1
Western Sahara	–	–	–	–	–	–
Northern Africa	–	–	–	–	–	–
Benin	243	n.s.	573	2	749	5
Burkina Faso	700	–	787	–	839	–
Burundi	137	–	231	11	87	11
Cameroon	–	–	–	–	1 865	20
Cape Verde	–	–	–	–	27	30
Central African Republic	400	8	450	9	462	10
Chad	603	2	710	2	789	3
Congo	–	–	–	–	–	–
Côte d'Ivoire	–	–	–	–	–	–
Democratic Republic of the Congo	–	–	–	–	–	–
Equatorial Guinea	130	6	130	6	155	6
Gabon	324	29	364	20	484	21
Gambia	185	1	185	1	194	3
Ghana	3 495	–	3 549	–	3 576	–
Guinea	–	–	–	–	–	–
Guinea-Bissau	292	11	284	14	263	11
Liberia	554	10	253	8	296	10
Mali	–	–	–	–	680	9

TABLE 17 (continued)
Human resources within public forest institutions 2000–2008

Country/area	2000		2005		2008	
	Number	% Female	Number	% Female	Number	% Female
Niger	610	–	538	–	877	10
Nigeria	10 741	8	11 200	9	13 120	9
Rwanda	–	–	–	–	213	11
Saint Helena, Ascension and Tristan da Cunha	–	–	39	3	35	3
Sao Tome and Principe	–	–	–	–	–	–
Senegal	568	11	832	13	876	16
Sierra Leone	210	10	200	9	195	8
Togo	–	–	–	–	–	–
Western and Central Africa	–	–	–	–	–	–
Africa	–	–	–	–	–	–
China	817 599	30	717 517	28	719 808	28
Democratic People's Republic of Korea	–	–	–	–	–	–
Japan	26 227	–	20 994	–	19 533	–
Mongolia	44	35	44	36	28	30
Republic of Korea	5 494	–	6 704	–	6 931	–
East Asia	–	–	–	–	–	–
Bangladesh	–	–	–	–	12 000	3
Bhutan	794	9	1 195	13	1 255	13
Brunei Darussalam	320	20	326	23	322	23
Cambodia	752	–	1 722	8	1 600	8
India	180 596	4	179 673	4	179 119	4
Indonesia	14 809	13	15 548	18	16 803	18
Lao People's Democratic Republic	–	–	–	–	–	–
Malaysia	11 000	–	8 400	–	8 600	–
Maldives	–	–	–	–	2	50
Myanmar	–	–	–	–	64 858	–
Nepal	8 400	3	9 200	3	9 545	3
Pakistan	–	–	–	–	–	–
Philippines	7 393	27	7 759	28	7 627	28
Singapore	–	–	–	–	–	–
Sri Lanka	2 418	12	2 319	10	2 483	10
Thailand	8 030	–	2 338	–	2 329	–
Timor-Leste	–	–	–	–	57	–
Viet Nam	–	–	–	–	–	–
South and Southeast Asia	–	–	–	–	–	–
Afghanistan	–	–	–	–	–	–
Armenia	–	–	–	–	–	–
Azerbaijan	–	–	2 552	–	–	–
Bahrain	–	–	–	–	–	–
Cyprus	459	7	440	7	448	6
Georgia	–	–	2 026	–	650	–
Iran (Islamic Republic of)	–	–	–	–	–	–
Iraq	–	–	–	–	–	–
Israel	1 100	10	800	10	550	10
Jordan	443	–	785	–	992	–
Kazakhstan	–	–	–	–	–	–
Kuwait	–	–	–	–	–	–
Kyrgyzstan	–	–	–	–	1 877	12
Lebanon	–	–	210	9	236	8
Occupied Palestinian Territory	–	–	–	–	–	–

TABLE 17 (continued)
Human resources within public forest institutions 2000–2008

Country/area	2000		2005		2008	
	Number	% Female	Number	% Female	Number	% Female
Oman	–	–	–	–	35	14
Qatar	–	–	–	–	–	–
Saudi Arabia	1 376	–	1 376	–	1 400	0
Syrian Arab Republic	2 564	–	2 787	–	3 057	–
Tajikistan	850	20	974	19	1 002	23
Turkey	18 897	11	13 972	11	15 957	12
Turkmenistan	–	–	–	–	–	–
United Arab Emirates	–	–	–	–	–	–
Uzbekistan	6 639	10	6 720	11	7 102	15
Yemen	192	10	192	10	192	10
Western and Central Asia	–	–	–	–	–	–
Asia	–	–	–	–	–	–
Albania	1 221	19	1 103	20	1 148	20
Andorra	–	–	–	–	–	–
Austria	701	–	492	–	561	2
Belarus	32 685	14	33 888	15	33 653	16
Belgium	1 551	–	1 696	15	1 728	16
Bosnia and Herzegovina	–	–	–	–	–	–
Bulgaria	9 239	35	7 734	35	1 329	30
Croatia	22	36	43	30	169	33
Czech Republic	–	–	–	–	–	–
Denmark	–	–	–	–	434	30
Estonia	137	23	227	27	241	32
Faroe Islands	–	–	–	–	–	–
Finland	–	–	–	–	1 587	–
France	12 347	–	11 413	–	10 977	–
Germany	–	–	–	–	–	–
Gibraltar	–	–	–	–	–	–
Greece	–	–	–	–	–	–
Guernsey	–	–	–	–	–	–
Holy See	–	–	–	–	–	–
Hungary	563	30	531	29	418	23
Iceland	54	29	58	24	60	30
Ireland	76	42	101	47	135	52
Isle of Man	–	–	–	–	–	–
Italy	8 304	11	7 940	12	8 374	15
Jersey	–	–	–	–	–	–
Latvia	1 688	27	1 705	37	1 598	37
Liechtenstein	–	–	–	–	–	–
Lithuania	–	–	140	41	155	47
Luxembourg	121	–	409	6	395	8
Malta	–	–	–	–	–	–
Monaco	–	–	–	–	–	–
Montenegro	–	–	–	–	–	–
Netherlands	1 000	–	1 000	20	970	22
Norway	–	–	–	–	84	27
Poland	–	–	–	–	–	–
Portugal	1 992	18	2 778	27	1 623	36
Republic of Moldova	–	–	–	–	–	–
Romania	298	15	301	19	573	13

TABLE 17 (continued)
Human resources within public forest institutions 2000–2008

Country/area	2000		2005		2008	
	Number	% Female	Number	% Female	Number	% Female
Russian Federation	–	–	–	–	–	–
San Marino	–	–	–	–	–	–
Serbia	121	35	98	36	94	37
Slovakia	–	–	–	–	–	–
Slovenia	835	15	836	15	835	15
Spain	9 229	9	9 139	13	10 165	13
Svalbard and Jan Mayen Islands	–	–	–	–	–	–
Sweden	1 000	–	1 329	25	1 006	32
Switzerland	–	–	–	–	360	15
The former Yugoslav Republic of Macedonia	150	–	153	7	159	8
Ukraine	–	–	–	–	939	–
United Kingdom	569	44	1 344	33	1 350	35
Europe	**–**	**–**	**–**	**–**	**–**	**–**
Anguilla	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–
Aruba	–	–	–	–	–	–
Bahamas	–	–	–	–	–	–
Barbados	–	–	–	–	24	50
Bermuda	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–
Cuba	–	–	458	41	2 619	17
Dominica	23	4	23	4	23	4
Dominican Republic	–	–	–	–	–	–
Grenada	55	15	55	15	55	15
Guadeloupe	–	–	–	–	118	43
Haiti	–	–	–	–	20	10
Jamaica	141	35	155	31	156	34
Martinique	–	–	–	–	101	18
Montserrat	11	27	11	27	12	27
Netherlands Antilles	–	–	–	–	–	–
Puerto Rico	–	–	–	–	–	–
Saint Kitts and Nevis	–	–	–	–	–	–
Saint Lucia	–	–	72	26	72	25
Saint Martin (French part)	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	–	–	–	–	–
Saint Barthélemy	–	–	–	–	–	–
Trinidad and Tobago	783	15	824	17	946	19
Turks and Caicos Islands	–	–	–	–	–	–
United States Virgin Islands	–	–	–	–	–	–
Caribbean	**–**	**–**	**–**	**–**	**–**	**–**
Belize	–	–	–	–	–	–
Costa Rica	–	–	1 225	26	52	53
El Salvador	84	24	82	28	84	24
Guatemala	–	–	–	–	367	27
Honduras	–	–	–	–	206	44
Nicaragua	–	–	–	–	332	38
Panama	–	–	–	–	126	17
Central America	**–**	**–**	**–**	**–**	**–**	**–**

TABLE 17 (continued)
Human resources within public forest institutions 2000–2008

Country/area	2000		2005		2008	
	Number	% Female	Number	% Female	Number	% Female
Canada	–	–	–	–	–	–
Greenland	–	–	–	–	–	–
Mexico	–	–	2 732	11	2 940	12
Saint Pierre and Miquelon	–	–	–	–	–	–
United States of America	–	–	–	–	29 637	38
North America	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–
American Samoa	–	–	–	–	–	–
Australia	–	–	–	–	–	–
Cook Islands	–	–	–	–	–	–
Fiji	118	3	163	3	167	6
French Polynesia	–	–	65	2	56	0
Guam	–	–	–	–	–	–
Kiribati	–	–	91	20	70	23
Marshall Islands	–	–	–	–	–	–
Micronesia (Federated States of)	–	–	–	–	–	–
Nauru	–	–	–	–	–	–
New Caledonia	–	–	–	–	81	37
New Zealand	1 490	–	1 746	–	1 875	–
Niue	8	25	5	20	4	25
Norfolk Island	–	–	–	–	–	–
Northern Mariana Islands	–	–	–	–	–	–
Palau	–	–	–	–	–	–
Papua New Guinea	–	–	–	–	337	25
Pitcairn	–	–	–	–	–	–
Samoa	–	–	–	–	–	–
Solomon Islands	–	–	59	18	116	25
Tokelau	–	–	–	–	–	–
Tonga	5	0	3	0	3	0
Tuvalu	–	–	–	–	–	–
Vanuatu	34	9	21	19	19	26
Wallis and Futuna Islands	–	–	–	–	4	0
Oceania	–	–	–	–	–	–
Argentina	99	48	99	49	148	51
Bolivia (Plurinational State of)	189	15	174	20	184	21
Brazil	–	–	619	–	1 080	–
Chile	–	–	1 600	25	1 733	26
Colombia	–	–	–	–	–	–
Ecuador	–	–	–	–	389	26
Falkland Islands (Malvinas)*	–	–	–	–	–	–
French Guiana	–	–	65	20	76	18
Guyana	140	39	160	38	242	27
Paraguay	–	–	–	–	370	13
Peru	–	–	–	–	532	29
Suriname	350	20	350	20	350	20
Uruguay	–	–	–	–	53	36
Venezuela (Bolivarian Republic of)	–	–	–	–	58	57
South America	–	–	–	–	–	–
World	–	–	–	–	–	–

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 18
Forest education and research 2008

Country/area	Graduation of students in forest related education						Professionals working in publicly funded forest research centres					
	M.Sc. or equivalent		B.Sc. or equivalent		Technician certificate/ diploma		Ph.D.		M.Sc. or equivalent		B.Sc. or equivalent	
	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female
Angola	0	0	0	0	0	0	–	–	–	–	–	–
Botswana	0	–	0	–	0	–	0	–	0	–	0	–
Comoros	–	–	–	–	–	–	–	–	–	–	–	–
Djibouti	–	–	–	–	–	–	–	–	–	–	–	–
Eritrea	0	–	33	9	327	11	0	–	2	0	4	0
Ethiopia	5	–	30	–	60	–	23	10	33	6	15	12
Kenya	–	–	–	–	81	–	17	–	56	–	14	–
Lesotho	0	–	0	–	31	23	0	–	0	–	0	–
Madagascar	–	–	–	–	–	–	–	–	–	–	–	–
Malawi	2	50	51	45	56	21	1	0	3	0	2	0
Mauritius	9	11	10	10	109	0	0	–	0	–	0	–
Mayotte	0	–	0	–	0	–	0	–	0	–	0	–
Mozambique	4	50	15	13	–	–	1	100	1	0	2	50
Namibia	0	–	0	–	1	–	0	–	2	–	2	–
Réunion	0	–	0	–	0	–	0	–	3	33	0	–
Seychelles	0	–	0	–	0	–	0	–	0	–	0	–
Somalia	0	–	0	–	0	–	0	–	0	–	0	–
South Africa	0	–	29	17	48	25	34	44	35	49	11	36
Swaziland	0	–	0	–	0	–	0	–	0	–	0	–
Uganda	–	–	–	–	–	–	4	–	12	–	4	–
United Republic of Tanzania	115	20	215	40	105	5	3	0	45	5	70	10
Zambia	4	0	20	25	36	15	0	–	6	30	24	40
Zimbabwe	–	–	–	–	25	–	0	–	8	25	16	31
Eastern and Southern Africa	–	–	–	–	–	–	–	–	–	–	–	–
Algeria	10	45	40	15	36	8	12	8	47	50	32	40
Egypt	4	25	24	25	32	40	12	30	15	33	18	33
Libyan Arab Jamahiriya	–	–	–	–	–	–	–	–	–	–	–	–
Mauritania	0	–	0	–	0	–	0	–	0	–	2	0
Morocco	21	14	0	–	28	0	9	0	36	11	0	–
Sudan	19	37	694	49	–	–	112	13	193	26	73	33
Tunisia	13	44	9	44	50	66	50	10	1	0	37	–
Western Sahara	–	–	–	–	–	–	–	–	–	–	–	–
Northern Africa	–	–	–	–	–	–	–	–	–	–	–	–
Benin	30	0	35	8	0	0	2	0	16	0	0	0
Burkina Faso	–	–	–	–	–	–	–	–	–	–	–	–
Burundi	0	–	–	–	40	5	1	0	3	33	3	33
Cameroon	–	–	–	–	–	–	–	–	–	–	–	–
Cape Verde	1	100	4	50	1	0	–	–	–	–	–	–
Central African Republic	4	0	–	–	10	30	1	0	3	0	–	–
Chad	16	13	19	0	47	0	–	–	–	–	–	–
Congo	–	–	–	–	–	–	–	–	–	–	–	–
Côte d'Ivoire	–	–	–	–	–	–	–	–	–	–	–	–
Democratic Republic of the Congo	–	–	–	–	–	–	–	–	–	–	–	–
Equatorial Guinea	0	–	0	–	2	0	0	–	7	0	7	0
Gabon	76	24	179	12	229	27	375	22	129	33	17	35

TABLE 18 (continued)
Forest education and research 2008

Country/area	Graduation of students in forest related education						Professionals working in publicly funded forest research centres					
	M.Sc. or equivalent		B.Sc. or equivalent		Technician certificate/ diploma		Ph.D.		M.Sc. or equivalent		B.Sc. or equivalent	
	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female
Gambia	0	–	0	–	10	0	0	–	0	–	0	–
Ghana	37	27	150	33	175	10	19	11	17	35	15	20
Guinea	157	16	–	–	24	20	1	–	4	–	1	–
Guinea-Bissau	0	–	0	–	0	–	0	–	0	–	0	–
Liberia	0	–	9	11	0	–	2	0	23	9	9	22
Mali	0	0	13	9	25	20	13	0	9	10	28	4
Niger	13	7	–	–	34	24	10	0	5	0	0	–
Nigeria	180	12	400	12	560	12	20	40	78	23	212	16
Rwanda	–	–	–	–	–	–	–	–	–	–	–	–
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–	–	–	–	–	–	–
Sao Tome and Principe	–	–	–	–	–	–	–	–	–	–	–	–
Senegal	81	11	136	10	445	4	4	0	8	50	3	30
Sierra Leone	0	–	0	–	0	–	0	–	0	–	0	–
Togo	–	–	–	–	–	–	–	–	–	–	–	–
Western and Central Africa	–	–	–	–	–	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–	–	–	–	–	–
China	3 926	–	31 850	–	18 563	–	494	–	1 020	–	3 909	–
Democratic People's Republic of Korea	–	–	–	–	–	–	–	–	–	–	–	–
Japan	110	33	435	33	230	–	–	–	–	–	–	–
Mongolia	5	30	16	30	0	0	2	–	5	20	2	50
Republic of Korea	–	–	952	51	358	58	192	8	47	15	45	51
East Asia	–	–	–	–	–	–	–	–	–	–	–	–
Bangladesh	75	5	125	5	150	1	10	10	79	14	13	–
Bhutan	5	25	7	29	48	0	0	0	0	0	3	33
Brunei Darussalam	–	–	–	–	–	–	–	–	–	–	–	–
Cambodia	–	–	25	24	–	–	–	–	–	–	–	–
India	565	55	808	50	3 000	2	394	24	1 002	23	1 289	18
Indonesia	1	–	307	47	126	26	42	24	223	35	523	38
Lao People's Democratic Republic	–	–	–	–	–	–	–	–	–	–	–	–
Malaysia	50	52	640	70	245	49	85	17	126	34	169	64
Maldives	–	–	–	–	–	–	–	–	–	–	–	–
Myanmar	23	4	–	–	–	–	–	–	–	–	–	–
Nepal	34	15	120	16	200	15	7	–	39	15	27	20
Pakistan	–	–	–	–	–	–	–	–	–	–	–	–
Philippines	17	35	487	50	82	26	47	53	140	60	370	59
Singapore	0	–	0	–	0	–	0	–	0	–	0	–
Sri Lanka	10	50	34	62	0	0	2	0	3	50	1	0
Thailand	–	–	–	–	–	–	–	–	–	–	–	–
Timor-Leste	2	–	9	–	50	–	–	–	–	–	–	–
Viet Nam	–	–	–	–	–	–	–	–	–	–	–	–
South and Southeast Asia	–	–	–	–	–	–	–	–	–	–	–	–
Afghanistan	–	–	–	–	–	–	–	–	–	–	–	–
Armenia	15	30	200	50	–	–	4	–	8	5	40	5
Azerbaijan	–	–	–	–	–	–	–	–	–	–	–	–

TABLE 18 (continued)
Forest education and research 2008

Country/area	Graduation of students in forest related education						Professionals working in publicly funded forest research centres					
	M.Sc. or equivalent		B.Sc. or equivalent		Technician certificate/ diploma		Ph.D.		M.Sc. or equivalent		B.Sc. or equivalent	
	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female
Bahrain	–	–	–	–	–	–	–	–	–	–	–	–
Cyprus	0	0	0	0	9	33	0	0	0	0	0	0
Georgia	13	–	64	–	–	–	36	22	15	33	1	100
Iran (Islamic Republic of)	–	–	–	–	–	–	–	–	–	–	–	–
Iraq	–	–	–	–	–	–	–	–	–	–	–	–
Israel	10	25	20	40	–	–	6	30	0	0	0	0
Jordan	0	0	–	–	0	0	–	–	–	–	–	–
Kazakhstan	–	–	325	34	350	21	17	35	4	25	6	17
Kuwait	–	–	–	–	–	–	–	–	–	–	–	–
Kyrgyzstan	90	–	–	–	95	–	6	50	20	45	4	50
Lebanon	0	0	0	0	0	0	0	0	0	0	0	0
Occupied Palestinian Territory	–	–	–	–	–	–	–	–	–	–	–	–
Oman	–	–	–	–	–	–	–	–	–	–	–	–
Qatar	–	–	–	–	–	–	–	–	–	–	–	–
Saudi Arabia	16	0	9	0	60	0	20	0	20	5	30	0
Syrian Arab Republic	–	–	–	–	13	–	–	–	–	–	44	54
Tajikistan	16	0	–	–	28	–	20	4	16	0	–	–
Turkey	83	24	589	23	67	24	55	38	68	28	73	29
Turkmenistan	–	–	–	–	–	–	–	–	–	–	–	–
United Arab Emirates	0	–	0	–	0	–	0	0	0	0	0	0
Uzbekistan	11	18	248	8	28	–	21	10	24	8	167	10
Yemen	0	–	0	–	0	–	0	–	0	–	0	–
Western and Central Asia	–	–	–	–	–	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–	–	–	–	–	–
Albania	–	–	142	28	0	0	14	14	2	50	–	–
Andorra	–	–	–	–	–	–	–	–	–	–	–	–
Austria	34	32	17	12	61	8	36	6	45	11	0	–
Belarus	170	24	0	–	334	33	3	0	–	–	–	–
Belgium	64	45	–	–	115	18	20	31	53	32	7	29
Bosnia and Herzegovina	–	–	–	–	–	–	–	–	–	–	–	–
Bulgaria	22	9	57	30	357	11	–	–	–	–	–	–
Croatia	2	50	75	16	0	–	15	33	10	30	16	50
Czech Republic	236	27	351	23	49	29	35	29	29	72	2	100
Denmark	23	22	46	24	54	15	92	32	65	65	2	50
Estonia	15	13	53	17	38	8	30	17	34	32	7	57
Faroe Islands	–	–	–	–	–	–	–	–	–	–	–	–
Finland	114	47	313	35	–	–	197	33	160	38	94	31
France	13	38	–	–	390	12	–	–	–	–	–	–
Germany	–	–	–	–	–	–	–	–	–	–	–	–
Gibraltar	–	–	–	–	–	–	–	–	–	–	–	–
Greece	–	–	–	–	–	–	–	–	–	–	–	–
Guernsey	–	–	–	–	–	–	–	–	–	–	–	–
Holy See	–	–	–	–	–	–	–	–	–	–	–	–
Hungary	29	20	–	–	144	4	27	26	42	29	1	100
Iceland	1	100	3	67	3	67	4	0	5	40	3	67

TABLE 18 (continued)
Forest education and research 2008

Country/area	Graduation of students in forest related education						Professionals working in publicly funded forest research centres					
	M.Sc. or equivalent		B.Sc. or equivalent		Technician certificate/ diploma		Ph.D.		M.Sc. or equivalent		B.Sc. or equivalent	
	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female
Ireland	4	0	28	7	11	0	28	21	28	11	29	34
Isle of Man	–	–	–	–	–	–	–	–	–	–	–	–
Italy	190	41	231	33	75	33	102	41	–	–	–	–
Jersey	–	–	–	–	–	–	–	–	–	–	–	–
Latvia	17	12	18	39	207	15	58	41	57	51	39	54
Liechtenstein	–	–	–	–	–	–	–	–	–	–	–	–
Lithuania	31	13	134	16	0	–	28	25	25	60	3	67
Luxembourg	0	–	0	–	13	39	0	–	0	–	0	–
Malta	–	–	–	–	–	–	–	–	–	–	–	–
Monaco	–	–	–	–	–	–	–	–	–	–	–	–
Montenegro	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	52	51	85	19	57	–	–	–	–	–	–	–
Norway	13	18	14	8	0	–	59	17	42	21	51	20
Poland	392	27	355	27	–	–	75	36	55	45	2	50
Portugal	125	55	23	57	–	–	–	–	–	–	–	–
Republic of Moldova	–	–	–	–	–	–	–	–	–	–	–	–
Romania	647	10	57	12	–	–	44	25	281	16	19	31
Russian Federation	3 000	–	–	–	9 500	–	–	–	–	–	–	–
San Marino	–	–	–	–	–	–	–	–	–	–	–	–
Serbia	17	47	204	57	95	5	89	28	75	52	198	37
Slovakia	63	25	93	18	223	7	150	23	59	34	1	0
Slovenia	4	75	33	30	28	29	34	24	5	0	35	34
Spain	357	46	427	43	1 733	21	460	29	414	44	278	41
Svalbard and Jan Mayen Islands	–	–	–	–	–	–	–	–	–	–	–	–
Sweden	90	31	31	10	2	100	155	27	72	40	15	20
Switzerland	4	75	59	32	35	3	51	11	119	34	12	0
The former Yugoslav Republic of Macedonia	2	0	84	40	–	–	35	20	2	50	3	67
Ukraine	202	27	477	25	2 884	17	–	–	–	–	–	–
United Kingdom	125	25	65	25	–	–	52	37	28	46	44	34
Europe	–	–	–	–	–	–	–	–	–	–	–	–
Anguilla	–	–	–	–	–	–	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	–	–	–	–	–	–	–
Bahamas	–	–	–	–	–	–	–	–	–	–	–	–
Barbados	0	–	0	–	0	–	0	–	0	–	1	100
Bermuda	–	–	–	–	–	–	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–	–	–	–	–	–	–
Cuba	10	60	24	33	–	–	–	–	–	–	–	–
Dominica	–	–	–	–	–	–	–	–	–	–	–	–
Dominican Republic	–	–	–	–	–	–	–	–	–	–	–	–
Grenada	0	–	0	–	0	–	0	–	0	–	0	–
Guadeloupe	0	–	0	–	0	–	0	–	0	–	0	–
Haiti	–	–	–	–	–	–	0	–	0	–	0	–
Jamaica	0	–	0	–	0	–	0	–	0	–	2	0

TABLE 18 (continued)
Forest education and research 2008

Country/area	Graduation of students in forest related education						Professionals working in publicly funded forest research centres					
	M.Sc. or equivalent		B.Sc. or equivalent		Technician certificate/ diploma		Ph.D.		M.Sc. or equivalent		B.Sc. or equivalent	
	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female
Martinique	–	–	–	–	–	–	–	–	–	–	–	–
Montserrat	1	0	1	0	4	0	–	–	–	–	–	–
Netherlands Antilles	–	–	–	–	–	–	–	–	–	–	–	–
Puerto Rico	–	–	–	–	–	–	–	–	–	–	–	–
Saint Kitts and Nevis	–	–	–	–	–	–	–	–	–	–	–	–
Saint Lucia	–	–	–	–	–	–	–	–	–	–	–	–
Saint Martin (French part)	–	–	–	–	–	–	–	–	–	–	–	–
Saint Vincent and the Grenadines	–	–	–	–	–	–	–	–	–	–	–	–
Saint Barthélemy	–	–	–	–	–	–	–	–	–	–	–	–
Trinidad and Tobago	0	–	0	–	20	45	0	–	2	0	1	100
Turks and Caicos Islands	–	–	–	–	–	–	–	–	–	–	–	–
United States Virgin Islands	–	–	–	–	–	–	–	–	–	–	–	–
Caribbean	–	–	–	–	–	–	–	–	–	–	–	–
Belize	–	–	–	–	–	–	–	–	–	–	–	–
Costa Rica	1	0	27	28	–	–	7	0	8	38	6	66
El Salvador	0	–	0	–	0	–	0	–	0	–	0	–
Guatemala	–	–	–	–	–	–	–	–	–	–	–	–
Honduras	15	27	27	26	14	43	–	–	–	–	–	–
Nicaragua	–	–	25	40	41	17	–	–	–	–	–	–
Panama	2	0	5	57	3	0	2	50	5	20	7	14
Central America	–	–	–	–	–	–	–	–	–	–	–	–
Canada	–	–	–	–	–	–	–	–	–	–	–	–
Greenland	–	–	–	–	–	–	–	–	–	–	–	–
Mexico	40	38	323	24	688	41	122	8	128	9	46	15
Saint Pierre and Miquelon	0	–	0	–	0	–	0	–	0	–	0	–
United States of America	955	44	4 172	38	94	19	696	21	499	35	620	37
North America	–	–	–	–	–	–	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–	–	–	–	–	–	–
American Samoa	–	–	–	–	–	–	–	–	–	–	–	–
Australia	–	–	30	–	–	–	–	–	–	–	–	–
Cook Islands	0	–	0	–	0	–	0	–	0	–	0	–
Fiji	1	–	1	–	18	28	–	–	1	–	9	22
French Polynesia	0	–	0	–	0	–	0	–	0	–	0	–
Guam	–	–	–	–	–	–	–	–	–	–	–	–
Kiribati	5	60	12	83	49	14	0	–	0	0	6	33
Marshall Islands	–	–	–	–	–	–	–	–	–	–	–	–
Micronesia (Federated States of)	–	–	–	–	–	–	–	–	–	–	–	–
Nauru	–	–	–	–	–	–	–	–	–	–	–	–
New Caledonia	0	–	–	–	0	–	5	0	6	55	0	–
New Zealand	–	–	–	–	–	–	54	24	58	29	110	35
Niue	0	0	0	0	0	0	0	0	0	0	0	0
Norfolk Island	–	–	–	–	–	–	–	–	–	–	–	–
Northern Mariana Islands	–	–	–	–	–	–	–	–	–	–	–	–
Palau	–	–	–	–	–	–	–	–	–	–	–	–
Papua New Guinea	1	0	36	29	13	54	0	–	2	0	50	4

TABLE 18 (continued)
Forest education and research 2008

Country/area	Graduation of students in forest related education						Professionals working in publicly funded forest research centres					
	M.Sc. or equivalent		B.Sc. or equivalent		Technician certificate/ diploma		Ph.D.		M.Sc. or equivalent		B.Sc. or equivalent	
	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female	Number	% Female
Pitcairn	–	–	–	–	–	–	–	–	–	–	–	–
Samoa	–	–	–	–	–	–	–	–	–	–	–	–
Solomon Islands	–	–	–	–	–	–	–	–	–	–	–	–
Tokelau	–	–	–	–	–	–	–	–	–	–	–	–
Tonga	0	–	0	–	3	67	0	–	0	–	0	–
Tuvalu	–	–	–	–	–	–	–	–	–	–	–	–
Vanuatu	0	–	0	–	0	–	0	–	0	–	0	–
Wallis and Futuna Islands	0	–	0	–	0	–	0	–	0	–	0	–
Oceania	–	–	–	–	–	–	–	–	–	–	–	–
Argentina	8	0	29	18	–	–	75	34	141	33	83	38
Bolivia (Plurinational State of)	0	–	–	–	–	–	0	–	0	–	0	–
Brazil	200	–	1 048	41	253	24	116	35	38	39	54	46
Chile	6	15	180	35	0	–	6	33	12	17	48	31
Colombia	56	3	292	2	44	1	–	–	–	–	–	–
Ecuador	–	–	6	–	–	–	–	–	–	–	–	–
Falkland Islands (Malvinas)*	–	–	–	–	–	–	–	–	–	–	–	–
French Guiana	0	0	20	50	0	0	27	25	14	50	6	67
Guyana	5	40	12	50	20	50	0	–	0	–	0	–
Paraguay	–	–	13	54	17	0	–	–	5	50	7	43
Peru	–	–	144	36	67	28	1	0	26	7	124	10
Suriname	0	–	2	50	40	10	1	0	2	50	8	50
Uruguay	3	–	12	33	–	–	4	–	3	–	7	–
Venezuela (Bolivarian Republic of)	4	75	98	48	68	29	29	31	89	34	14	29
South America	–	–	–	–	–	–	–	–	–	–	–	–
World	–	–	–	–	–	–	–	–	–	–	–	–

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 19
Forest revenue and public expenditure on forestry 2005

Country/area	Forest revenue	Public expenditure (1 000 US$)					
		Domestic funding		External funding		Total	
	1 000 US$	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments
Angola	71	410	–	–	–	410	–
Botswana	111	–	–	–	–	–	–
Comoros	–	–	–	–	–	–	–
Djibouti	–	–	–	–	–	–	–
Eritrea	–	–	–	–	–	–	–
Ethiopia	–	–	–	–	–	–	–
Kenya	–	–	–	–	–	–	–
Lesotho	–	–	–	–	–	–	–
Madagascar	–	–	–	–	–	–	–
Malawi	1 388	456	–	1 351	–	1 807	–
Mauritius	1 214	6 279	0	0	0	6 279	0
Mayotte	–	–	–	–	–	–	–
Mozambique	6 489	–	–	–	–	345	–
Namibia	88	–	–	–	–	–	–
Réunion	0	1 492	0	2 238	0	3 731	0
Seychelles	–	–	–	–	–	–	–
Somalia	–	–	–	–	–	–	–
South Africa	7 349	63 392	2 797	–	–	–	–
Swaziland	–	388	0	275	0	663	0
Uganda	–	–	–	–	–	–	–
United Republic of Tanzania	11 637	6 489	11 515	26 574	32 774	33 063	44 290
Zambia	1 038	–	–	–	–	–	–
Zimbabwe[a]	–	–	–	–	–	–	–
Eastern and Southern Africa	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Algeria	4 612	102 257	0	9 368	0	111 625	0
Egypt	11 418	6 057	0	–	0	6 057	0
Libyan Arab Jamahiriya	–	–	–	–	–	–	–
Mauritania	–	565	–	–	–	565	–
Morocco	76 838	170 675	517	14 255	0	184 930	517
Sudan[a]	–	–	–	–	–	–	–
Tunisia	11 260	26 976	0	5 395	0	32 371	0
Western Sahara	–	–	–	–	–	–	–
Northern Africa	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Benin	3 886	2 451	410	15 925	–	18 376	410
Burkina Faso	607	2 287	–	3 202	–	5 490	–
Burundi	–	–	–	–	–	–	–
Cameroon	46 896	–	–	–	–	–	–
Cape Verde	–	–	–	–	–	–	–
Central African Republic	7 945	–	–	–	–	–	–
Chad	286	666	–	381	–	1 046	–
Congo	47 396	–	–	–	–	–	–
Côte d'Ivoire	–	–	–	–	–	–	–
Democratic Republic of the Congo	–	–	–	–	–	–	–
Equatorial Guinea	11 954	5 032	1 198	0	417	5 032	1 615
Gabon	16 478	1 412	2 250	n.s.	4 171	516	178
Gambia	90	171	0	8 034	0	8 205	0
Ghana	–	–	–	–	–	–	–

TABLE 19 (continued)
Forest revenue and public expenditure on forestry 2005

Country/area	Forest revenue	Public expenditure (1 000 US$)					
		Domestic funding		External funding		Total	
	1 000 US$	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments
Guinea	–	–	–	–	–	–	–
Guinea-Bissau	121	72	–	48	–	121	–
Liberia	–	633	–	–	–	633	–
Mali	692	3 608	–	17 640	–	21 248	–
Niger	1 739	–	–	–	–	–	–
Nigeria	–	4	0	–	–	4	0
Rwanda	359	–	–	–	–	–	–
Saint Helena, Ascension and Tristan da Cunha	–	–	–	–	–	–	–
Sao Tome and Principe	–	–	–	–	–	–	–
Senegal	3 157	6 525	12 323	17 152	15 404	23 677	27 727
Sierra Leone	648	623	0	467	–	1 090	–
Togo	140	–	–	–	–	–	–
Western and Central Africa	–	–	–	–	–	–	–
Africa	–	–	–	–	–	–	–
China	311 065	142 909	4 776 996	–	–	–	–
Democratic People's Republic of Korea	–	–	–	–	–	–	–
Japan	262 393	–	–	–	–	–	–
Mongolia	658	222	415	33	–	256	415
Republic of Korea	485 013	832 474	26 346	0	0	832 474	26 346
East Asia	–	–	–	–	–	–	–
Bangladesh	–	–	–	–	–	–	–
Bhutan	–	–	–	–	–	–	–
Brunei Darussalam	501	6 544	–	34	–	6 578	–
Cambodia	1 415	1 005	–	–	–	1 005	–
India	341 819	–	–	–	–	–	–
Indonesia	334 766	–	–	–	–	–	–
Lao People's Democratic Republic	–	–	–	–	–	–	–
Malaysia	424 123	98 547	–	–	–	98 547	–
Maldives	–	–	–	–	–	–	–
Myanmar	2 041	–	–	–	–	–	–
Nepal	8 449	22 265	340	4 523	0	26 788	340
Pakistan	–	–	–	–	–	–	–
Philippines	2 476	35 988	–	–	–	35 988	–
Singapore	–	–	–	–	–	–	–
Sri Lanka	3 113	3 605	0	3 926	139	7 670	139
Thailand	1 137	–	–	–	–	–	–
Timor-Leste	–	942	–	400	50	1 342	50
Viet Nam	–	28 690	154 046	0	41 428	28 690	195 474
South and Southeast Asia	–	–	–	–	–	–	–
Afghanistan	–	–	–	–	–	–	–
Armenia	1 389	–	–	–	–	–	–
Azerbaijan	–	–	–	–	–	–	–
Bahrain	–	–	–	–	–	–	–
Cyprus	743	38 259	2	98	0	38 357	2
Georgia	–	–	–	–	–	–	–
Iran (Islamic Republic of)	–	–	–	–	–	–	–

TABLE 19 (continued)
Forest revenue and public expenditure on forestry 2005

Country/area	Forest revenue	Public expenditure (1 000 US$)					
		Domestic funding		External funding		Total	
	1 000 US$	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments
Iraq	–	–	–	–	–	–	–
Israel	–	–	–	–	–	12 701	0
Jordan	–	4 106	0	–	0	–	0
Kazakhstan	–	–	–	–	–	–	–
Kuwait	–	–	–	–	–	–	–
Kyrgyzstan	1 005	520	–	–	–	520	–
Lebanon	1 004	2 856	528	2 741	1 032	5 597	1 559
Occupied Palestinian Territory	–	–	–	–	–	–	–
Oman	–	–	–	–	–	–	–
Qatar	–	–	–	–	–	–	–
Saudi Arabia	–	8 273	10 675	–	–	8 273	10 675
Syrian Arab Republic	752	34 226	0	233	0	34 460	0
Tajikistan	1 476	706	1 283	0	0	706	1 283
Turkey	653 525	432 172	27 974	434	0	432 607	27 974
Turkmenistan	–	–	–	–	–	–	–
United Arab Emirates	–	–	–	–	–	–	–
Uzbekistan	6 846	4 890	–	0	0	4 890	–
Yemen	–	37	–	0	0	37	–
Western and Central Asia	–	–	–	–	–	–	–
Asia	–	–	–	–	–	–	–
Albania	1 054	6 202	2 341	674	371	6 876	2 711
Andorra	–	–	–	–	–	–	–
Austria	–	98 119	34 186	0	11 043	98 120	45 230
Belarus	70 026	65 606	0	0	0	65 606	0
Belgium	87 920	30 522	8 738	1 926	659	32 448	9 395
Bosnia and Herzegovina	–	–	–	–	–	–	–
Bulgaria	45 987	42 359	14 834	0	666	42 359	15 500
Croatia	0	792	0	0	0	792	0
Czech Republic	–	–	29 418	–	5 717	–	35 133
Denmark	34 051	99 851	22 311	0	0	99 851	22 311
Estonia	–	–	1 398	–	1 384	–	2 783
Faroe Islands	–	–	–	–	–	–	–
Finland	–	–	–	–	–	–	–
France	–	283 216	99 363	0	54 320	283 216	153 684
Germany	–	–	157 937	–	0	–	157 937
Gibraltar	–	–	–	–	–	–	–
Greece	–	–	–	–	–	–	–
Guernsey	–	–	–	–	–	–	–
Holy See	–	–	–	–	–	–	–
Hungary	20 137	22 582	49 698	3 645	14 377	26 226	64 075
Iceland	0	10 338	4 260	61	45	10 399	4 305
Ireland	–	21 620	50 027	0	73 535	21 620	123 562
Isle of Man	–	–	–	–	–	–	–
Italy	–	693 663	560 640	122 821	31 489	816 483	592 128
Jersey	–	–	–	–	–	–	–
Latvia	–	–	–	–	–	–	–
Liechtenstein	–	–	–	–	–	–	–

TABLE 19 (continued)
Forest revenue and public expenditure on forestry 2005

Country/area	Forest revenue	Public expenditure (1 000 US$)					
		Domestic funding		External funding		Total	
	1 000 US$	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments
Lithuania	32 222	4 614	72	0	0	4 614	72
Luxembourg	1 308	–	–	–	–	–	–
Malta	–	–	–	–	–	–	–
Monaco	–	–	–	–	–	–	–
Montenegro	–	–	–	–	–	–	–
Netherlands	–	105 042	23 770	–	–	–	–
Norway	–	–	–	–	–	–	–
Poland	42 295	44 336	18 368	0	9 411	44 336	27 778
Portugal	15 539	57 379	63 847	880	34 598	58 260	98 446
Republic of Moldova	–	–	–	–	–	–	–
Romania	–	30 802	368	2 435	0	33 237	368
Russian Federation	1 016 268	–	–	–	–	988 758	–
San Marino	–	–	–	–	–	–	–
Serbia	10 055	1 431	5 891	764	0	2 195	5 891
Slovakia	1 900	7 844	6 347	0	2 599	7 844	8 946
Slovenia	29 218	22 091	1 061	0	815	22 091	1 876
Spain	–	–	–	–	–	–	–
Svalbard and Jan Mayen Islands	–	–	–	–	–	–	–
Sweden	3 582 354	73 977	140 186	6 396	0	80 374	140 186
Switzerland	–	2 570	107 936	0	0	2 570	107 936
The former Yugoslav Republic of Macedonia	41 336	–	–	–	–	–	–
Ukraine	388 528	331 853	–	7 663	–	339 516	–
United Kingdom	0	209 455	65 091	3 636	22 182	213 092	87 273
Europe	**–**	**–**	**–**	**–**	**–**	**–**	**–**
Anguilla	–	–	–	–	–	–	–
Antigua and Barbuda	–	–	–	–	–	–	–
Aruba	–	–	–	–	–	–	–
Bahamas	–	–	–	–	–	–	–
Barbados	–	–	–	–	–	–	–
Bermuda	–	–	–	–	–	–	–
British Virgin Islands	–	–	–	–	–	–	–
Cayman Islands	–	–	–	–	–	–	–
Cuba	6 246	145 000	0	0	0	145 000	0
Dominica	–	–	–	–	–	–	–
Dominican Republic	–	–	–	–	–	–	–
Grenada	4	4	3	0	0	4	3
Guadeloupe	110	589	–	260	–	849	–
Haiti	–	–	–	–	–	–	–
Jamaica	23	1 939	0	31	0	1 969	0
Martinique	129	897	0	0	0	897	0
Montserrat	–	–	–	–	–	–	–
Netherlands Antilles	–	–	–	–	–	–	–
Puerto Rico	–	–	–	–	–	–	–
Saint Kitts and Nevis	–	–	–	–	–	–	–
Saint Lucia	105	–	–	–	–	–	–
Saint Martin (French part)	–	–	–	–	–	–	–

TABLE 19 (continued)
Forest revenue and public expenditure on forestry 2005

Country/area	Forest revenue	Public expenditure (1 000 US$)					
		Domestic funding		External funding		Total	
	1 000 US$	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments
Saint Vincent and the Grenadines	–	–	–	–	–	–	–
Saint Barthélemy	–	–	–	–	–	–	–
Trinidad and Tobago	1 178	13 870	113	–	–	13 870	113
Turks and Caicos Islands	–	–	–	–	–	–	–
United States Virgin Islands	–	–	–	–	–	–	–
Caribbean	–	–	–	–	–	–	–
Belize	–	–	–	–	–	–	–
Costa Rica	14	17	12	0	93	17	21
El Salvador	43	43	0	400	0	443	0
Guatemala	22 828	1 998	–	–	13 080	1 998	13 080
Honduras	44 286	13 488	–	25 204	–	38 692	–
Nicaragua	1 442	1 801	–	1 622	–	3 423	–
Panama	–	–	–	–	–	–	–
Central America	–	–	–	–	–	–	–
Canada	1 264 886	–	–	–	–	–	–
Greenland	–	–	–	–	–	–	–
Mexico	–	89 007	110 426	2 120	4 099	91 128	114 524
Saint Pierre and Miquelon	–	–	–	–	–	–	–
United States of America	–	5 236 549	640 756	–	–	–	–
North America	–	–	–	–	–	–	–
North and Central America	–	–	–	–	–	–	–
American Samoa	–	–	–	–	–	–	–
Australia	–	–	–	–	–	–	–
Cook Islands	–	–	–	–	–	–	–
Fiji	2 259	5 739	–	–	–	5 739	–
French Polynesia	16	5	–	–	–	5	–
Guam	–	–	–	–	–	–	–
Kiribati	7	805	–	350	–	1 155	–
Marshall Islands	–	–	–	–	–	–	–
Micronesia (Federated States of)	–	–	–	–	–	–	–
Nauru	–	–	–	–	–	–	–
New Caledonia	–	–	–	–	–	–	–
New Zealand	101 966	–	–	0	0	–	–
Niue	–	–	–	–	–	–	–
Norfolk Island	–	–	–	–	–	–	–
Northern Mariana Islands	–	–	–	–	–	–	–
Palau	–	–	–	–	–	–	–
Papua New Guinea	41 908	7 552	–	–	–	7 552	–
Pitcairn	–	–	–	–	–	–	–
Samoa	–	–	–	–	–	–	–
Solomon Islands	–	–	–	–	–	–	–
Tokelau	–	–	–	–	–	–	–
Tonga	26	201	21	15	36	216	57
Tuvalu	–	–	–	–	–	–	–
Vanuatu	45	460	–	247	–	707	–
Wallis and Futuna Islands	–	–	–	–	–	–	–
Oceania	–	–	–	–	–	–	–

TABLE 19 (continued)
Forest revenue and public expenditure on forestry 2005

Country/area	Forest revenue	Public expenditure (1 000 US$)					
		Domestic funding		External funding		Total	
	1 000 US$	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments	Operational expenditure	Transfer payments
Argentina	–	3 830	9 161	908	0	4 738	9 161
Bolivia (Plurinational State of)	–	–	–	–	–	–	–
Brazil	3 272 185	41 288	1 628	4 204	583	45 492	2 212
Chile	4 752	44 922	49 610	–	–	44 922	49 610
Colombia	–	–	–	–	–	–	–
Ecuador	–	136	–	240	–	376	–
Falkland Islands (Malvinas)*	–	–	–	–	–	–	–
French Guiana	1 318	3 999	0	0	1 525	3 999	1 525
Guyana	2 552	2 101	0	0	0	2 101	0
Paraguay	1 025	982	0	0	0	982	–
Peru	6 501	–	–	–	–	–	–
Suriname	1 180	549	–	110	–	659	–
Uruguay	–	–	–	–	–	–	–
Venezuela (Bolivarian Republic of)	–	–	–	–	–	–	–
South America	**–**	**–**	**–**	**–**	**–**	**–**	**–**
World	**–**	**–**	**–**	**–**	**–**	**–**	**–**

[a] Although data on forest revenue and expenditure were provided by Sudan and Zimbabwe it was not possible to convert the figures to US$ due to the highly fluctuating exchange rate.

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

TABLE 20
Status of ratification of international conventions and agreements as of 1 January 2010

Country/Area	CBD[a]	UNFCCC[b]	Kyoto Protocol[c]	UNCCD[d]	ITTA[e]	CITES[f]	Ramsar[g]	World Heritage Convention[h]	NLBI[i]
Angola	X	X	X	X				X	X
Botswana	X	X	X	X		X	X	X	X
Comoros	X	X	X	X		X	X	X	X
Djibouti	X	X	X	X		X	X	X	X
Eritrea	X	X	X	X		X		X	X
Ethiopia	X	X	X	X		X		X	X
Kenya	X	X	X	X		X	X	X	X
Lesotho	X	X	X	X		X	X	X	X
Madagascar	X	X	X	X		X	X	X	X
Malawi	X	X	X	X		X	X	X	X
Mauritius	X	X	X	X		X	X	X	X
Mayotte									
Mozambique	X	X	X	X		X	X	X	X
Namibia	X	X	X	X		X	X	X	X
Réunion									
Seychelles	X	X	X	X		X	X	X	X
Somalia	X	X		X		X			X
South Africa	X	X	X	X		X	X	X	X
Swaziland	X	X	X	X		X		X	X
Uganda	X	X	X	X		X	X	X	X
United Republic of Tanzania	X	X	X	X		X	X	X	X
Zambia	X	X	X	X		X	X	X	X
Zimbabwe	X	X	X	X		X		X	X
Eastern and Southern Africa	**21**	**21**	**20**	**21**	**0**	**20**	**15**	**20**	**21**
Algeria	X	X	X	X		X	X	X	X
Egypt	X	X	X	X	X	X	X	X	X
Libyan Arab Jamahiriya	X	X	X	X		X	X	X	X
Mauritania	X	X	X	X		X	X	X	X
Morocco	X	X	X	X		X	X	X	X
Sudan	X	X	X	X		X	X	X	X
Tunisia	X	X	X	X		X	X	X	X
Western Sahara									
Northern Africa	**7**	**7**	**7**	**7**	**1**	**7**	**7**	**7**	**7**
Benin	X	X	X	X		X	X	X	X
Burkina Faso	X	X	X	X		X	X	X	X
Burundi	X	X	X	X		X	X	X	X
Cameroon	X	X	X	X	X	X	X	X	X
Cape Verde	X	X	X	X		X	X	X	X
Central African Republic	X	X	X	X	X	X	X	X	X
Chad	X	X	X	X		X	X	X	X
Congo	X	X	X	X	X	X	X	X	X
Côte d'Ivoire	X	X	X	X	X	X	X	X	X
Democratic Republic of the Congo	X	X	X	X	X	X	X	X	X
Equatorial Guinea	X	X	X	X		X	X	X	X
Gabon	X	X	X	X	X	X	X	X	X
Gambia	X	X	X	X		X	X	X	X
Ghana	X	X	X	X	X	X	X	X	X

TABLE 20 (continued)
Status of ratification of international conventions and agreements as of 1 January 2010

Country/Area	CBD[a]	UNFCCC[b]	Kyoto Protocol[c]	UNCCD[d]	ITTA[e]	CITES[f]	Ramsar[g]	World Heritage Convention[h]	NLBI[i]
Guinea	X	X	X	X		X	X	X	X
Guinea-Bissau	X	X	X	X		X	X	X	X
Liberia	X	X	X	X	X	X	X	X	X
Mali	X	X	X	X		X	X	X	X
Niger	X	X	X	X		X	X	X	X
Nigeria	X	X	X	X	X	X	X	X	X
Rwanda	X	X	X	X		X	X	X	X
Saint Helena, Ascension and Tristan da Cunha									
Sao Tome and Principe	X	X	X	X		X	X	X	X
Senegal	X	X	X	X		X	X	X	X
Sierra Leone	X	X	X	X		X	X	X	X
Togo	X	X	X	X	X	X	X	X	X
Western and Central Africa	**25**	**25**	**25**	**25**	**10**	**25**	**25**	**25**	**25**
Africa	**53**	**53**	**52**	**53**	**11**	**52**	**47**	**52**	**53**
China	X	X	X	X	X	X	X	X	X
Democratic People's Republic of Korea	X	X	X	X				X	X
Japan	X	X	X	X	X	X	X	X	X
Mongolia	X	X	X	X		X	X	X	X
Republic of Korea	X	X	X	X	X	X	X	X	X
East Asia	**5**	**5**	**5**	**5**	**3**	**4**	**4**	**5**	**5**
Bangladesh	X	X	X	X		X	X	X	X
Bhutan	X	X	X	X		X		X	X
Brunei Darussalam	X	X	X	X		X			X
Cambodia	X	X	X	X	X	X	X	X	X
India	X	X	X	X	X	X	X	X	X
Indonesia	X	X	X	X	X	X	X	X	X
Lao People's Democratic Republic	X	X	X	X		X	X	X	X
Malaysia	X	X	X	X	X	X	X	X	X
Maldives	X	X	X	X				X	X
Myanmar	X	X	X	X	X	X	X	X	X
Nepal	X	X	X	X	X	X	X	X	X
Pakistan	X	X	X	X		X	X	X	X
Philippines	X	X	X	X	X	X	X	X	X
Singapore	X	X	X	X		X			X
Sri Lanka	X	X	X	X		X	X	X	X
Thailand	X	X	X	X	X	X	X	X	X
Timor-Leste	X	X	X	X					X
Viet Nam	X	X	X	X		X	X	X	X
South and Southeast Asia	**18**	**18**	**18**	**18**	**8**	**16**	**13**	**15**	**18**
Afghanistan	X	X		X		X		X	X
Armenia	X	X	X	X		X	X	X	X
Azerbaijan	X	X	X	X		X	X	X	X
Bahrain	X	X	X	X			X	X	X
Cyprus	X	X	X	X		X	X	X	X
Georgia	X	X	X	X		X	X	X	X

TABLE 20 (continued)
Status of ratification of international conventions and agreements as of 1 January 2010

Country/Area	CBD[a]	UNFCCC[b]	Kyoto Protocol[c]	UNCCD[d]	ITTA[e]	CITES[f]	Ramsar[g]	World Heritage Convention[h]	NLBI[i]
Iran (Islamic Republic of)	X	X	X	X		X	X	X	X
Iraq	X	X	X				X	X	X
Israel	X	X	X	X		X	X	X	X
Jordan	X	X	X	X		X	X	X	X
Kazakhstan	X	X	X	X		X	X	X	X
Kuwait	X	X	X	X		X		X	X
Kyrgyzstan	X	X	X	X		X	X	X	X
Lebanon	X	X	X	X			X	X	X
Occupied Palestinian Territory									
Oman	X	X	X	X		X		X	X
Qatar	X	X	X	X		X		X	X
Saudi Arabia	X	X	X	X		X		X	X
Syrian Arab Republic	X	X	X	X		X	X	X	X
Tajikistan	X	X	X	X			X	X	X
Turkey	X	X	X	X		X	X	X	X
Turkmenistan	X	X	X	X			X	X	X
United Arab Emirates	X	X	X	X		X	X	X	X
Uzbekistan	X	X	X	X		X	X	X	X
Yemen	X	X	X	X		X	X	X	X
Western and Central Asia	**24**	**24**	**23**	**23**	**0**	**19**	**19**	**24**	**24**
Asia	**47**	**47**	**46**	**46**	**11**	**39**	**36**	**44**	**47**
Albania	X	X	X	X		X	X	X	X
Andorra				X				X	X
Austria	X	X	X	X	X	X	X	X	X
Belarus	X	X	X	X		X	X	X	X
Belgium	X	X	X	X	X	X	X	X	X
Bosnia and Herzegovina	X	X	X	X		X	X	X	X
Bulgaria	X	X	X	X		X	X	X	X
Croatia	X	X	X	X		X	X	X	X
Czech Republic	X	X	X	X		X	X	X	X
Denmark	X	X	X	X	X	X	X	X	X
Estonia	X	X	X			X	X	X	X
Faroe Islands									
Finland	X	X	X	X	X	X	X	X	X
France	X	X	X	X	X	X	X	X	X
Germany	X	X	X	X	X	X	X	X	X
Gibraltar									
Greece	X	X	X	X	X	X	X	X	X
Guernsey									
Holy See								X	
Hungary	X	X	X	X		X	X	X	X
Iceland	X	X	X	X		X	X	X	X
Ireland	X	X	X	X	X	X	X	X	X
Isle of Man									
Italy	X	X	X	X	X	X	X	X	X
Jersey									

TABLE 20 (continued)
Status of ratification of international conventions and agreements as of 1 January 2010

Country/Area	CBD[a]	UNFCCC[b]	Kyoto Protocol[c]	UNCCD[d]	ITTA[e]	CITES[f]	Ramsar[g]	World Heritage Convention[h]	NLBI[i]
Latvia	X	X	X	X		X	X	X	X
Liechtenstein	X	X	X	X		X	X		X
Lithuania	X	X	X	X		X	X	X	X
Luxembourg	X	X	X	X	X	X	X	X	X
Malta	X	X	X	X		X	X	X	X
Monaco	X	X	X	X		X	X	X	X
Montenegro	X	X	X	X		X	X	X	X
Netherlands	X	X	X	X	X	X	X	X	X
Norway	X	X	X	X	X	X	X	X	X
Poland	X	X	X	X	X	X	X	X	X
Portugal	X	X	X	X	X	X	X	X	X
Republic of Moldova	X	X	X	X		X	X	X	X
Romania	X	X	X	X		X	X	X	X
Russian Federation	X	X	X	X		X	X	X	X
San Marino	X	X	X	X		X		X	X
Serbia	X	X	X	X		X	X	X	X
Slovakia	X	X	X	X		X	X	X	X
Slovenia	X	X	X	X		X	X	X	X
Spain	X	X	X	X	X	X	X	X	X
Svalbard and Jan Mayen Islands									
Sweden	X	X	X	X	X	X	X	X	X
Switzerland	X	X	X	X	X	X	X	X	X
The former Yugoslav Republic of Macedonia	X	X	X	X		X	X	X	X
Ukraine	X	X	X	X		X	X	X	X
United Kingdom	X	X	X	X	X	X	X	X	X
Europe	**42**	**42**	**42**	**42**	**18**	**42**	**41**	**43**	**43**
Anguilla									
Antigua and Barbuda	X	X	X	X		X	X	X	X
Aruba									
Bahamas	X	X	X	X		X	X		X
Barbados	X	X	X	X		X	X	X	X
Bermuda									
British Virgin Islands									
Cayman Islands									
Cuba	X	X	X	X		X	X	X	X
Dominica	X	X	X	X		X		X	X
Dominican Republic	X	X	X	X		X	X	X	X
Grenada	X	X	X	X		X		X	X
Guadeloupe									
Haiti	X	X	X	X				X	X
Jamaica	X	X	X	X		X	X	X	X
Martinique									
Montserrat									
Netherlands Antilles									
Puerto Rico									

TABLE 20 (continued)
Status of ratification of international conventions and agreements as of 1 January 2010

Country/Area	CBD[a]	UNFCCC[b]	Kyoto Protocol[c]	UNCCD[d]	ITTA[e]	CITES[f]	Ramsar[g]	World Heritage Convention[h]	NLBI[i]
Saint Kitts and Nevis	X	X	X	X		X		X	X
Saint Lucia	X	X	X	X		X	X	X	X
Saint Martin (French part)									
Saint Vincent and the Grenadines	X	X	X	X		X		X	X
Saint Barthélemy									
Trinidad and Tobago	X	X	X	X	X	X	X	X	X
Turks and Caicos Islands									
United States Virgin Islands									
Caribbean	**13**	**13**	**13**	**13**	**1**	**12**	**8**	**12**	**13**
Belize	X	X	X	X		X	X	X	X
Costa Rica	X	X	X	X		X	X	X	X
El Salvador	X	X	X	X		X	X	X	X
Guatemala	X	X	X	X	X	X	X	X	X
Honduras	X	X	X	X	X	X	X	X	X
Nicaragua	X	X	X	X		X	X	X	X
Panama	X	X	X	X	X	X	X	X	X
Central America	**7**	**7**	**7**	**7**	**3**	**7**	**7**	**7**	**7**
Canada	X	X	X	X	X	X	X	X	X
Greenland									
Mexico	X	X	X	X	X	X	X	X	X
Saint Pierre and Miquelon									
United States of America		X	X	X	X	X	X	X	X
North America	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
North and Central America	**22**	**23**	**23**	**23**	**7**	**22**	**18**	**22**	**23**
American Samoa									
Australia	X	X	X	X	X	X	X	X	X
Cook Islands	X	X	X	X				X	
Fiji	X	X	X	X	X	X	X	X	X
French Polynesia									
Guam									
Kiribati	X	X	X	X				X	X
Marshall Islands	X	X	X	X			X	X	X
Micronesia (Federated States of)	X	X	X	X				X	X
Nauru	X	X	X	X					X
New Caledonia									
New Zealand	X	X	X	X	X	X	X	X	X
Niue	X	X	X	X				X	
Norfolk Island									
Northern Mariana Islands									
Palau	X	X	X	X		X	X	X	X
Papua New Guinea	X	X	X	X	X	X	X	X	X
Pitcairn									
Samoa	X	X	X	X		X	X	X	X
Solomon Islands	X	X	X	X		X		X	X
Tokelau									
Tonga	X	X	X	X				X	X

TABLE 20 (continued)
Status of ratification of international conventions and agreements as of 1 January 2010

Country/Area	CBD[a]	UNFCCC[b]	Kyoto Protocol[c]	UNCCD[d]	ITTA[e]	CITES[f]	Ramsar[g]	World Heritage Convention[h]	NLBI[i]
Tuvalu	X	X	X	X					X
Vanuatu	X	X	X	X	X	X		X	X
Wallis and Futuna Islands									
Oceania	**16**	**16**	**16**	**16**	**5**	**8**	**7**	**14**	**14**
Argentina	X	X	X	X		X	X	X	X
Bolivia (Plurinational State of)	X	X	X	X	X	X	X	X	X
Brazil	X	X	X	X	X	X	X	X	X
Chile	X	X	X	X		X	X	X	X
Colombia	X	X	X	X	X	X	X	X	X
Ecuador	X	X	X	X	X	X	X	X	X
Falkland Islands (Malvinas)*									
French Guiana									
Guyana	X	X	X	X	X	X		X	X
Paraguay	X	X	X	X		X	X	X	X
Peru	X	X	X	X	X	X	X	X	X
Suriname	X	X	X	X	X	X	X	X	X
Uruguay	X	X	X	X		X	X	X	X
Venezuela (Bolivarian Republic of)	X	X	X	X	X	X	X	X	X
South America	**12**	**12**	**12**	**12**	**8**	**12**	**11**	**12**	**12**
World	**192**	**193**	**191**	**192**	**60**	**175**	**160**	**187**	**192**

Note: Ratification in this table also covers accession, acceptance and approval. Ratification by a country also covers its dependent territories. However, to avoid double-counting these territories appear without an X in the table.

Source:
[a] CBD: http://www.cbd.int/convention/parties/list/
[b] UNFCCC: http://unfccc.int/parties_and_observers/parties/items/2352.php
[c] Kyoto Protocol: http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php
[d] UNCCD: http://www.unccd.int/convention/ratif/doeif.php
[e] ITTA: http://whc.unesco.org/en/statesparties/
[f] CITES: http://www.cites.org/eng/disc/parties/alphabet.shtml
[g] Ramsar: http://www.ramsar.org/cda/en/ramsar-about-parties-contracting-parties-to-23808/main/ramsar/1-36-123%5E23808_4000_0__
[h] World Heritage Convention: http://whc.unesco.org/en/statesparties/
[i] NLBI: http://www.un.org/en/members/

* A dispute exists between the governments of Argentina and the United Kingdom of Great Britain and Northern Ireland concerning sovereignty over the Falkland Islands (Malvinas).

Annex 4
FRA 2010 Working papers

The key findings of FRA 2010, the country reports and all relevant background documents are available on the FAO web site www.fao.org/forestry/fra2010.

A complete list of all the working papers prepared by the FRA programme can be found at: www.fao.org/forestry/site/2560/en.

This annex lists those FRA Working Papers directly related to FRA 2010. Paper copies can be requested by e-mail to fra@fao.org, or by ordinary mail to FAO, Forestry Department, FRA Programme, Viale delle Terme di Caracalla, 00153 Rome, Italy.

E, F, S, A, R, C refers to the languages English, French, Spanish, Arabic, Chinese and Russian.

Number	Title
135	Specification of national reporting tables for FRA 2010 (E, F, S, A, R)
142	Forest monitoring and assessment for climate change reporting: partnerships, capacity building and delivery (E)
143	Guidelines for country reporting to FRA 2010 (E, F, S, A, R)
145	Proc. technical meeting of the national correspondents, Global Forest Resources Assessment 2010, 3–7 March 2008, Rome, Italy (E)
146	Proc. FRA 2010 regional workshop for national correspondents for the Asian region, 13–16 October 2008, Kuala Lumpur, Malaysia (E)
147	Proc. FRA 2010 regional workshops for national correspondents and focal points for the Pacific Region, 18-20 April 2008, Hanoi, Viet Nam; 19-21 November 2008, Nadi, Fiji (E)
148	Proc. FRA 2010 regional workshop for national correspondents for Anglophone Africa, 7–9 October 2008, Nairobi, Kenya (E)
150	Proc. FRA 2010 regional workshop for national correspondents and focal points for the Near East region, 13–16 October 2008, Alexandria, Egypt (E)
151	Compte-rendu de l'atelier régional FRA 2010 pour les correspondants nationaux et les points focaux des pays francophones de l'Afrique, 10–12 Décembre 2008, Bamako, Mali (F)
152	Acta de la reunión regional de FRA 2010 para los corresponsales nacionales de habla hispana, 28–30 de octubre 2008, Brasilia (S)
153	Proc. FRA 2010 regional workshop for national correspondents from English-speaking Latin America and the Caribbean countries, 2–4 December 2008, Castries, Saint Lucia (E)
154	Towards defining forest degradation: comparative analysis of existing definitions, 8–10 September 2009, Rome, Italy, Simula, M. (E, F, S)

Number	Title
155	FRA 2010 remote sensing survey – An outline of objectives, data, methods and approach (E)
156	Community measurement of carbon stock change for REDD. *Case studies on measuring and assessing forest degradation* Skutsch, M.M, McCall, M.K., Karky, B., Zahabu E. & Peters-Guarin, G. (E)
157	Addressing forest degradation in the context of joint forest management in Udaipur, India. *Case studies on measuring and assessing forest degradation.* Kleine, M., Shahabuddin, G. & Kant, P. (E)
158	An operational approach to forest degradation. *Case studies on measuring and assessing forest degradation.* Bahamóndez, C., Martin, M., Müller-Using, S., Rojas, Y. & Vergara, G. (E)
159	Defaunation and forest degradation in Central African logging concessions: how to measure the impacts of bush meat hunting on the ecosystem. *Case studies on measuring and assessing forest degradation* Nasi, R. & van Vliet, N. (E)
160	Assessment of forest degradation by local communities: the case study of Ghana. *Case studies on measuring and assessing forest degradation.* Blay, D., Dwomoh, F.K. & Damnyag, L. (E)
161	Integrating forest transects and remote sensing data to quantify carbon loss due to forest degradation in the Brazilian Amazon. *Case studies on measuring and assessing forest degradation.* De Souza, C.M., Cochrane, M.A., Sales, M.H., Monteiro, A.L. & Mollicone, D. (E)
162	Monitoring degradation in the scope of REDD. *Case studies on measuring and assessing forest degradation* Baldauf, T., Plugge, D., Rqibate, A. & Köhl, M. (E)
163	Forest degradation in Nepal: review of data and methods. *Case studies on measuring and assessing forest degradation.* Acharya K.P. & Dangi, R.B. (E)
164	Impact of developmental projects in the humid evergreen broad-leaved forest: Wasabi pilot project at Lamperi, Western Bhutan. *Case studies on measuring and assessing forest degradation* Wangda, P., Gyaltshen, D. & Pradhan, R. (E)
165	Measuring ecological impacts from logging in natural forests of the eastern Amazônia as a tool to assess forest degradation. *Case studies on measuring and assessing forest degradation.* Lentini, M.W., Zweede, J.C. & Holmes, T.P. (E)
166	Global mapping and monitoring the extent of forest alteration: the intact forest landscapes method. *Case studies on measuring and assessing forest degradation.* Potapov, P., Laestadius, L., Yaroshenko, A. & Turubanova, S. (E)
167	Extrait de l'inventaire forestier des forêts classées autour de Bamako *Etudes de cas sur l'évaluation de la dégradation des forêts,* Tangara, N.O. (F)
168	Occupation des sols des forets classées du Niger et l'analyse des dynamiques de changement *Etudes de cas sur l'évaluation de la dégradation des forêts*, Adamou, I. et Garba, A. (F)
169	La dégradation des forêts en République Démocratique du Congo *Etudes de cas sur l'évaluation de la dégradation des forêts*, Kamungandu, C.M. (F)

Number	Title
170	Surveillance et suivi de la santé des forêts au Maroc *Etudes de cas sur l'évaluation de la dégradation des forêts* Assali, F. (F)
171	Technical meeting on assessment and monitoring of forest degradation 8-10 September 2009, Rome, Italy-Summary report (2009) (E, F, S)
172	Measuring and monitoring forest degradation through national forest monitoring assessment *Case studies on measuring and assessing forest degradation* Tavani, R., Saket, M., Piazza, M., Branthomme, A. & Altrell, D. (E)
173	Analysis of the normalized differential vegetation index (NDVI) for the detection of degradation of forest coverage in Mexico 2008–2009 *Case studies on measuring and assessing forest degradation* Meneses Tovar, C.L. (E, S)
174	"LADA-LOCAL" A local level land degradation assessment approach and a case study of its use in Senegal *Case studies on measuring and assessing forest degradation* Bunning, S. & Ndiaye, D.S. (E)
175	Results of pathological monitoring in degraded Russian forests *Case studies on measuring and assessing forest degradation* Moiseev, B. (E)
176	Forest resources degradation accounting in Mongolia *Case studies on measuring and assessing forest degradation* Ykhanbai, H. (E)
177	Terms and definitions for FRA 2010. Rome, Italy (E, F, S, A, R, C)

Annex 5

FRA 2010 meetings and workshops

Venue and date	Name of meeting
Rome, Italy 17–18 January 2006	Fifth meeting of the advisory group on global forest resources assessment
Kotka, Finland 12–16 June 2006	Expert consultation on global forest resources assessment: toward FRA 2010
Rome, Italy 11–12 January 2007	Sixth meeting of the FAO advisory group on global forest resource assessment
Rome, Italy 3–7 March 2008	Technical meeting of the national correspondents, global forest resources assessment 2010
Rome, Italy 7 March 2008	Seventh meeting of the advisory group on global forest resources assessment
Hanoi, Viet Nam 18–20 April 2008	Pacific workshop on the global forest resources assessment 2010
Victoria, Canada 3–5 June 2008	North American Forestry Commission Working Group on forest inventory, monitoring, and assessment
Nairobi, Kenya 7–9 October 2008	Regional workshop for national correspondents for Anglophone Africa
Kuala Lumpur, Malaysia 13–16 October 2008	Regional workshop for national correspondents for the Asian region
Alexandria, Egypt 13–16 October 2008	Regional workshop for national correspondents and focal points for the Near East region
Brasilia, Brazil 28–30 October 2008	Reunión regional de FRA 2010 para los corresponsales nacionales de habla hispana
Budapest, Hungary 3–5 November 2008	Regional workshop for national correspondents from Russian-speaking Europe and CIS
Douala, Cameroun 10–12 November 2008	Atelier sous-régional pour l'Afrique centrale sur l'évaluation des ressources forestières mondiales 2010
Nadi, Fiji 17–21 November 2008	FRA 2010 regional workshops for national correspondents and focal points for the Pacific region
Castries, Saint Lucia 2–4 December 2008	Regional workshop for national correspondents from English-Speaking Latin America and the Caribbean countries
Bamako, Mali 10–12 December 2008	L'Atelier régional FRA 2010 pour les correspondants nationaux et les points focaux des pays francophones de l'Afrique

Venue and date	Name of meeting
Rome, Italy 18 March 2009	Eighth meeting of the FAO advisory group on global forest resource assessment
Buenos Aires, Argentina 22 October 2009	Ninth meeting of the FAO advisory group on global forest resource assessment

Annex 6
Earlier global assessments

FAO was founded on 16 October 1945. At the first session of the Conference of FAO, the need for up-to-date information on the forest resources of the world was highlighted. This reflected concern for a possible future lack of timber, not least due to the needs for reconstruction after the Second World War and for support to development in tropical countries. It was recommended, therefore, that a global forest resources inventory should be undertaken as soon as possible. In May 1946, the Forestry and Forest Products Division was founded and work initiated on FAO's first worldwide assessment of forests, published two years later (FAO, 1948). After reviewing the results of this assessment, the sixth session of the FAO Conference recommended that the Organization "maintain a permanent capability to provide information on the state of forest resources worldwide on a continuing basis" (FAO, 1951). Since that time, regional and global surveys have been conducted every five to ten years. Each has taken a somewhat different form.

Statistics released by FAO on world forest area from 1948 through 1963 were largely collected through questionnaires sent to the countries. The assessments since 1980 have taken a more solid technical form, being based on analysis of country references supported by expert judgements, remote sensing and statistical modelling.

FRA 2000 was based on a range of references and information on forest area, the condition of forests and their management, forest services and NWFPs. FRA 2000 was also notable for applying, for the first time, a single definition of forest at the global level with common minimum thresholds, including a 10 percent crown cover density.

FRA 2005 was the most comprehensive assessment of its time, and encouraged active participation by reporting countries. More than 800 people were involved in the process, including 172 officially nominated country correspondents, together with their national teams, the FRA advisory group, FAO and UNECE staff, consultants and volunteers from all around the world. Information was gathered and analysed for 229 countries at three points in time: 1990, 2000 and 2005. The FAO team, countries and specialists worked together on the design and implementation of FRA 2005, through expert consultations, training courses, regional meetings and ongoing communication. The FRA 2005 process resulted in greater knowledge of forest resources and forestry, facilitated transparent reporting, and enhanced national capacity to collect, analyse and report on more than 40 variables covering the extent, condition, uses and values of forest resources and other wooded land. The findings were presented according to six main themes and aimed at assessing progress towards sustainable forest management.

Statistics from the different assessments do not lend themselves to comparative analysis, owing to changes in baseline information, methods and definitions. However, better correlations can be achieved for time series in many countries for certain assessments, especially with information generated since 1980. Consistent definitions of forests were applied for developing countries for subsequent assessments – and for all countries as of FRA 2000.

FAO'S GLOBAL AND REGIONAL ASSESSMENTS 1946–2001

Forest resources of the world (1948)

For the first global survey, *Forest resources of the world* (FAO, 1948), a questionnaire was sent to all countries, with 101 responding, which represented about 66 percent of

the world's forests. Parameters included were forest area (total and productive), types of forest by accessibility of wood resources, growth and fellings.

One of the noteworthy conclusions of the first report was that:

> *"All these investigations made valuable additions to our knowledge, but all suffered from certain fundamental difficulties. Most important of these were the lack of reliable forest inventory information … and the lack of commonly accepted definitions of some of the more important forestry terms. Hence, to the weakness of some of the quantitative estimates, there was added doubt as to the real meanings of some of the qualitative descriptions" (FAO, 1948).*

While technical and scientific advances have greatly increased the potential to improve the information base in countries, many still lack the training, institutional and financial resources to conduct periodic assessments.

Major findings on forest area and forest area change

- Total forest area (global): 4.0 billion hectares
- Net forest change (global): not reported

World forest inventories (1953, 1958 and 1963)

World forest inventories were carried out on three occasions during the 1950s and 1960s. Lanly (1983) describes these various inventories:

> *...126 countries and territories replied to the 1953 questionnaire representing about 73 percent of the world forest area. The picture was completed by information from the replies to the 1947 questionnaire for 10 other countries (representing 3 percent of the total world forested area) and official statistics for the remaining 57 countries, representing 24 percent of the world forest area. The results were published by FAO in 1955 under the title* World forest resources – results of the inventory undertaken in 1953 by the Forestry Division of FAO.
>
> *The 1958 inventory … (*World Forest Inventory 1958 – *the third in the quinquennial series compiled by the Forestry and Forest Products Division of FAO)* [FAO, 1960] *utilized the replies of the 143 countries or territories, representing 88 percent of the world forest area, complemented by the replies to the 1953 questionnaire for 13 countries (2 percent) and to the 1947 questionnaire for 5 countries (3 percent). Necessary changes and precisions introduced in the definition of some concepts, more precise definitions of forests and changes in such concepts as forest-in-use and accessible forests affected comparability with the previous inventories. However, changes in area and other forest characteristics during the 1953-58 period were, for several countries, either reported directly from them or could be derived by comparison of the replies to both questionnaires (changes in area of permanent forests, in management status ... increase in accessible areas and in forest-in-use, afforested area between 1953 and 1957, etc.).*
>
> *The* World Forest Inventory 1963 *published by FAO in 1965 witnessed a slightly lower rate of response (105 compared to 130), "at least partly accounted for by temporary strains on administration in countries gaining their independence" as was reported in the document. Again comparability with the former enquiries was limited, and, as pointed out by the authors of the report, "large differences for some countries (between the results of the 1958 and 1963 enquiries) resulted more from better knowledge about the forests, or stricter application of definitions, than from effective changes in the forest resources".*

The main parameters assessed during the *World forest inventory 1963* were forest area (total, productive and protected), ownership, management status, composition (softwoods and hardwoods), growing stock and removals (FAO, 1966).

Major findings on forest area and forest area change (1963)

- Total forest area (global): 3.8 billion hectares
- Net forest change: not reported

Regional forest resources assessments (1970s)

During the 1970s, FAO did not carry out global surveys. Instead, a series of regional assessments were conducted, with the intention that each would be more appropriate and specific to the regions. Beginning in the late 1960s, FAO sent out questionnaires to all industrialized countries. The results were published in 1976 as *Forest resources of the European Region* (FAO, 1976b). Questionnaires were also sent to Asia and Latin America, and the results were published in *Forest resources in the Asia and Far East Region* (FAO, 1976c) and *Appraisal of forest resources of the Latin American Region* (FAO, 1976a). A similar questionnaire was sent to African countries by the Department of Forest Survey of the Swedish Royal College of Forestry and the results published in *Forest resources of Africa – an approach to international forest resources appraisal, Part I: country descriptions* (Persson, 1975) and *Part II: Regional analyses* (Persson, 1977).

According to Lanly (1983), the regional assessments of the developing countries had the following main features in common:

- they were based only in part upon questionnaires, the rest of the information having been collected in another form, in particular through travel to countries of the region concerned;
- they included more qualitative information (description of forest types, indication of species planted, quotation of figures on volumes and other stand characteristics extracted from inventory reports, etc.), while the *World Forest Inventory* assessments were essentially statistical;
- in addition to regional statistical tables, country notes were prepared regrouping the quantitative information selected for each country;
- since the information provided was not limited to the replies to the questionnaires, the draft country notes were sent back to the national forest institutions for their comments and suggested amendments.

Although FAO did not compile the regional findings into a global synthesis, a global survey was done outside FAO and published in *World forest resources – review of the world's forest resources in the early 1970s* (Persson, 1974). Another FAO study, *Attempt at an assessment of the world's tropical moist forests* (Sommer, 1976), provided a summary of findings on the forest situation in all tropical moist forests.

FRA 1980

FRA 1980 covered 97 percent of the land area of developing countries or 76 tropical countries: 37 in Africa, 16 in Asia and 23 in Latin America and the Caribbean. FRA 1980 was distinguished by many features. Its breadth was the greatest up to that time, and in many cases remains unmatched by more recent assessments. It is also notable as the first assessment to use a definition of forests in which measurable parameters were indicated – 10 percent canopy cover density, minimum tree height of 7 m and 10 ha as the minimum area. Previous assessments had relatively broad definitions, which could be interpreted quite differently by different countries. This consistent definition provided parameters useful in adjusting country information to a common standard. An adjustment in time was also made, using expert opinion to project the information to common reference years of 1976, 1980, 1981 and 1985.

FRA 1980 relied extensively on existing documentation from countries to formulate its estimates of forest area (status and change), plantation resources and wood volume.

Existing information from multiple sources in the countries was gathered and analysed. Dialogues with national and international experts on information utility and reliability helped to firm up country estimates. The assessment noted that information was abundant, but that it was hard to locate and synthesize in the coherent manner needed for a consistent global survey.

Extended narratives, explanatory text and qualitative information complemented the statistical data set. During the tenure of FRA 1980, FAO was conducting extensive work on forest inventories in tropical countries. Roughly one project existed for every two to three countries, and FAO experts in the projects provided valuable input to the 1980 assessment results.

In major forested areas for which existing information was lacking, the assessment conducted manual interpretations of satellite imagery (1:1 000 000 scale). This was done for six Latin American countries, two African countries, two Asian countries and portions of two other Asian countries. The interpretations covered about 70–99 percent of these countries, using 55 satellite images.

The final documentation for FRA 1980 included three volumes of country briefs (one for each developing country region) (FAO, 1981a, b and c), three regional summaries and a condensed main report, published as an FAO Forestry Paper (FAO, 1982). While the findings were not global, FRA 1980 was used again in 1988 to make an interim global assessment.

Major findings on forest area and forest area change

- Total forest area (tropical developing countries only) 1980: 2.1 billion hectares (natural forests and plantations)
- Net forest change (tropical developing countries only) 1981–1985: -10.2 million hectares per year
- Net forest change (global): not reported

Interim assessment 1988

The *Interim report on the state of forest resources in the developing countries* (FAO, 1988) provided information on 129 developing countries (53 more than FRA 1980) as well as on industrialized countries. The report provided information on the state of forests in the year 1980 and changes over the period 1981–1985. Definitions varied between the industrialized and developing countries specifically for crown cover thresholds for forests, which were set at 20 percent for industrialized countries and 10 percent for developing ones. Information on the industrialized countries was collected by UNECE in Geneva, which drew on the report *Forest resources of the ECE region (Europe, the USSR, North America)* (UNECE and FAO, 1985). Parameters varied as well for the two groups of countries. Thus a global synthesis of core elements was needed in order to achieve a uniform global data set.

Elements of the global synthesis included forest, operable forest, inoperable forest, other wooded land, broad-leaved forest and coniferous forest.

Major findings on forest area and forest area change

- Total forest area (global) 1980: 3.6 billion hectares
- Net forest change (tropical developing countries) 1981–1985: -11.4 million hectares per year
- Net forest change (global): not reported

FRA 1990

FRA 1990 (FAO, 1995) covered all developing and industrialized countries and was distinguished by two innovations: the development and use of a computerized 'deforestation model', which was applied to the developing country data in order to

project forest area statistics to a common reference year; and an independent, pan-tropical remote sensing survey of forest change based on high-resolution remote sensing data.

FRA 1990 sought to improve estimates by eliminating the bias in expert opinions through a statistical model for predicting forest area loss (and thus deforestation rates). The model was based on forest area change derived from the few comparable multi-date assessments available. Deforestation rates were then regressed against independent variables to determine the rate of forest loss relative to changes in population densities within specific ecological zones. Forest area change rates were obtained by applying the model to available baseline statistics for the countries.

The advantages of the 1990 method were the near-uniformity achieved by applying the model equally to almost all developing countries and the ability to streamline the production of statistics using computer routines.[38] The disadvantages of the 1990 method were the low number of variables used in the deforestation algorithm and the low number of observations used to construct the model, introducing a relatively high random error (i.e. low precision) in country estimates.

Because of the many uncertainties involved in working with existing national data, FRA 1990 implemented a remote sensing survey to provide a quality-controlled set of statistics on forest resources. The use of statistical sampling combined with a uniform data source (satellite imagery) and standard data-collection methods were important tools in providing a set of statistics to compare with the country data.

The survey relied on statistical sampling (10 percent) of the world's tropical forests through 117 sample units distributed throughout the tropics. Based on the sampling, estimates were produced of the status of and changes in tropical forests at regional, ecological and pan-tropical levels (but not at the national level). Each of the sample units consisted of multi-date, Landsat satellite images, which provided the raw material for producing statistics on forest and other land cover changes from 1980 to 1990.

FAO used an interdependent, manual interpretation of satellite scenes at a scale of 1:250 000, conducted by local professionals, where possible, and internationally experienced professionals in other areas. Multi-date image interpretations were manually compared to one another. Ground information was incorporated into about 50 percent of the interpretations. In some areas, ground truthing was not necessary, owing to the large and consistent amount of forest. In other locations, especially where the composition of the landscape was highly differentiated, it was found to be very valuable.

The principal output of the remote sensing survey was a change matrix that illustrated and quantified how the forest and landscape change over time. The forest and land cover classification scheme of the remote sensing survey was linked closely to the FRA classes for global reporting by countries.

Different definitions of forests for developing and industrialized countries limited the utility of the final global synthesis, as did the absence of change information on forests in industrialized countries. Only changes in the area of forest, combined with other wooded land, were assessed (the definition of forest was again set at 20 percent crown cover density for industrialized countries and 10 percent for developing countries).

The assessment covered the parameters of volume, biomass, annual harvesting (tropics) and plantations. Brief summaries were also prepared on conservation, forest

[38] Two different models were used – one for the tropics and one for subtropical areas. Other differences among countries included the lack of: baseline data in some countries, a uniform ecological map and comparable multi-date observations.

management and biological diversity. Unfortunately, the country briefs prominent in FRA 1980 were discontinued.

Major findings on forest area and forest area change

- Total forest area (global) 1990: 3.4 billion hectares
- Net forest change (tropical developing countries) 1980–1990: -13.6 million hectares per year
- Net forest change (global) 1980–1990: -9.9 million hectares per year (forest and other wooded land combined)

Interim 1995 assessment

An interim 1995 assessment was published in *State of the World's Forests 1997* (FAO, 1997). This report published new statistics on forest area status and change for all countries with a reference year of 1995, and a change interval from 1991–1995. The definition of forest set canopy closure thresholds at 20 percent for industrialized countries and 10 percent for developing countries.

The baseline information set was drawn, with a minimum of updating, from FRA 1990 data and had an average reference year of 1983. Although FAO contacted all developing countries and requested their latest inventory reports, updated information was submitted and used only for Bolivia, Brazil, Cambodia, Côte d'Ivoire, Guinea-Bissau, Mexico, Papua New Guinea, the Philippines and Sierra Leone.

The FRA 1990 deforestation model was used to adjust developing country statistics to standard reference years (1991 and 1995). No adjustments to standard reference years were made for industrialized country statistics. Consequently, the industrialized and developing country data were not harmonized in terms of their definitions or reference year.

Major findings on forest area and forest area change

- Total forest area (global) 1995: 3.4 billion hectares
- Net forest change (tropical developing countries) 1990–1995: -12.7 million hectares per year
- Net forest change (global): -11.3 million hectares per year (total forests)

FRA 2000

FRA 2000 improved on previous assessments in several ways. It covered more countries and parameters and used a single global definition of forest. The average national inventory year for information was closer to the global reporting year than in previous assessments. More support than in the past was given to country capacity-building; and new technologies, such as remote sensing, were used extensively. Reliability of the results was thus greatly enhanced, but there were still many information gaps.

In FRA 2000, a uniform definition of forest – 10 percent canopy cover – was used for all regions of the world. Revised estimates were made for the area of temperate and boreal forests in 1990 using the definition and methodology adopted in 2000.

An independent remote sensing survey used the same 117 sample units used in FRA 1990 and added recent Landsat satellite images, which made the production of statistics possible on forest and other land cover changes from 1980 to 2000. The resulting change matrix illustrated and quantified changes in the forest and landscape over time. The survey showed different patterns among regions within the tropics, which may have reflected general land-use patterns and policies. In Latin America, large-scale, direct conversion of forests dominated. Direct conversions also dominated in Africa, but on a smaller scale. In Asia, the area of gradual conversions (intensification of shifting agriculture) was equal to the direct conversions from forests to other land

uses. At the global level, direct conversions dominated the picture, accounting for about three-quarters of the converted area. Most tropical deforestation was thus a result of rapid, planned or large-scale conversion to other land uses, mainly agriculture.

Efforts were made to increase the transparency and availability of background information. Many working papers were published in order to provide details on key countries and topics. Statistics, together with their underlying analyses and assumptions, were published on the FAO website. Countries were officially requested to confirm their key statistics before publication. As a follow-up, a dedicated issue of *Unasylva* (FAO, 2002) reviewed forest resources assessment processes at global and national levels. The Kotka IV expert consultation in 2002 also reviewed the FRA 2000 process and results (Luhtala and Varjo, 2003).

Major findings on forest area and forest area change

- Total forest area (global) 2000: Nearly 3.9 billion hectares, of which 95 percent was natural forest and 5 percent forest plantations
- Net forest change (global) 1990–2000: -9.4 million hectares per year (forest)
- Global deforestation 1990–2000: 14.6 million hectares per year
- Global increase in forest area due to afforestation and natural expansion of forests during the same period: average of 5.2 million hectares per year
- Net forest change (tropical countries) 1990–2000: -12.3 million hectares per year
- Net forest change (non-tropical countries) 1990–2000: +2.9 million hectares per year

FRA 2005

The Global Forest Resources Assessment 2005 (FRA 2005) involved more than 800 people including national correspondents and their teams, an advisory group, international experts, FAO and UNECE staff, consultants and volunteers from around the world.

Information was collected and analysed for 229 countries and areas for three points in time: 1990, 2000 and 2005. FAO worked closely with countries and specialists in the design and implementation of FRA 2005 – through regular contact, expert consultations, training for national correspondents and ten regional and subregional workshops. This process represented a truly global partnership that resulted in improved knowledge of the world's forests and forestry, a more transparent reporting process, and enhanced capacity in data analysis and reporting.

FRA 2005 examined the status and recent trends for more than 40 variables covering the extent, condition, uses and values of forests and other wooded land, with the aim of assessing the benefits derived from forest resources. The results were presented according to six themes representing important elements of sustainable forest management:

- extent of forest resources;
- biological diversity;
- forest health and vitality;
- productive functions of forest resources;
- protective functions of forest resources;
- socio-economic functions.

Major findings on forest area and forest area change

- Total forest area (global) 2005: Just over 3.95 billion hectares, of which primary forest accounted for 36 percent, modified natural forest accounted for 53 percent, semi-natural forest accounted for 7 percent, productive plantations for 3 percent and protective plantations 0.8 percent

- Net forest change (global) 1990–2000: -8.9 million hectares per year (forest)
- Net forest change (global) 2000–2005: -7.3 million hectares per year (forest)
- Global deforestation 1990–2005: 13 million hectares per year with no significant change over time
- Global increase in forest area due to afforestation and natural expansion of forests: an average of 4.1 million hectares per year during 1990–2000 and 5.7 million hectares per year during 2000–2005

FAO TECHNICAL PAPERS

FAO FORESTRY PAPERS

1	Forest utilization contracts on public land, 1977 (E F S)
2	Planning forest roads and harvesting systems, 1977 (E F S)
3	World list of forestry schools, 1977 (E/F/S)
3 Rev.1	World list of forestry schools, 1981 (E/F/S)
3 Rev.2	World list of forestry schools, 1986 (E/F/S)
4/1	World pulp and paper demand, supply and trade – Vol. 1, 1977 (E F S)
4/2	World pulp and paper demand, supply and trade – Vol. 2, 1977 (E F S)
5	The marketing of tropical wood in South America, 1976 (E S)
6	National parks planning, 1976 (E F S)
7	Forestry for local community development, 1978 (Ar E F S)
8	Establishment techniques for forest plantations, 1978 (Ar C E* F S)
9	Wood chips – production, handling, transport, 1976 (C E S)
10/1	Assessment of logging costs from forest inventories in the tropics – 1. Principles and methodology, 1978 (E F S)
10/2	Assessment of logging costs from forest inventories in the tropics – 2. Data collection and calculations, 1978 (E F S)
11	Savanna afforestation in Africa, 1977 (E F)
12	China: forestry support for agriculture, 1978 (E)
13	Forest products prices 1960-1977, 1979 (E/F/S)
14	Mountain forest roads and harvesting, 1979 (E)
14 Rev.1	Logging and transport in steep terrain, 1985 (E)
15	AGRIS forestry – world catalogue of information and documentation services, 1979 (E/F/S)
16	China: integrated wood processing industries, 1979 (E F S)
17	Economic analysis of forestry projects, 1979 (E F S)
17 Sup.1	Economic analysis of forestry projects: case studies, 1979 (E S)
17 Sup.2	Economic analysis of forestry projects: readings, 1980 (C E)
18	Forest products prices 1960-1978, 1980 (E/F/S)
19/1	Pulping and paper-making properties of fast-growing plantation wood species – Vol. 1, 1980 (E)
19/2	Pulping and paper-making properties of fast-growing plantation wood species – Vol. 2, 1980 (E)
20	Forest tree improvement, 1985 (C E F S)
20/2	A guide to forest seed handling, 1985 (E S)
21	Impact on soils of fast-growing species in lowland humid tropics, 1980 (E F S)
22/1	Forest volume estimation and yield prediction – Vol. 1. Volume estimation, 1980 (C E F S)
22/2	Forest volume estimation and yield prediction – Vol. 2. Yield prediction, 1980 (C E F S)
23	Forest products prices 1961-1980, 1981 (E/F/S)
24	Cable logging systems, 1981 (C E)
25	Public forestry administrations in Latin America, 1981 (E)
26	Forestry and rural development, 1981 (E F S)
27	Manual of forest inventory, 1981 (E F)
28	Small and medium sawmills in developing countries, 1981 (E S)
29	World forest products, demand and supply 1990 and 2000, 1982 (E F S)
30	Tropical forest resources, 1982 (E F S)
31	Appropriate technology in forestry, 1982 (E)
32	Classification and definitions of forest products, 1982 (Ar/E/F/S)
33	Logging of mountain forests, 1982 (E F S)
34	Fruit-bearing forest trees, 1982 (E F S)
35	Forestry in China, 1982 (C E)
36	Basic technology in forest operations, 1982 (E F S)
37	Conservation and development of tropical forest resources, 1982 (E F S)
38	Forest products prices 1962-1981, 1982 (E/F/S)
39	Frame saw manual, 1982 (E)
40	Circular saw manual, 1983 (E)
41	Simple technologies for charcoal making, 1983 (E F S)
42	Fuelwood supplies in the developing countries, 1 983 (Ar E F S)
43	Forest revenue systems in developing countries, 1983 (E F S)
44/1	Food and fruit-bearing forest species – 1. Examples from eastern Africa, 1983 (E F S)
44/2	Food and fruit-bearing forest species – 2. Examples from southeastern Asia, 1984 (E F S)
44/3	Food and fruit-bearing forest species – 3. Examples from Latin America, 1986 (E S)
45	Establishing pulp and paper mills, 1983 (E)
46	Forest products prices 1963-1982, 1983 (E/F/S)
47	Technical forestry education – design and implementation, 1984 (E F S)
48	Land evaluation for forestry, 1984 (C E F S)
49	Wood extraction with oxen and agricultural tractors, 1986 (E F S)
50	Changes in shifting cultivation in Africa, 1984 (E F)
50/1	Changes in shifting cultivation in Africa – seven case-studies, 1985 (E)
51/1	Studies on the volume and yield of tropical forest stands – 1. Dry forest formations, 1989 (E F)
52/1	Cost estimating in sawmilling industries: guidelines, 1984 (E)
52/2	Field manual on cost estimation in sawmilling industries, 1985 (E)
53	Intensive multiple-use forest management in Kerala, 1984 (E F S)
54	Planificación del desarrollo forestal, 1984 (S)
55	Intensive multiple-use forest management in the tropics, 1985 (E F S)
56	Breeding poplars for disease resistance, 1985 (E)
57	Coconut wood – Processing and use, 1985 (E S)
58	Sawdoctoring manual, 1985 (E S)
59	The ecological effects of eucalyptus, 1985 (C E F S)

60 Monitoring and evaluation of participatory forestry projects, 1985 (E F S)
61 Forest products prices 1965-1984, 1985 (E/F/S)
62 World list of institutions engaged in forestry and forest products research, 1985 (E/F/S)
63 Industrial charcoal making, 1985 (E)
64 Tree growing by rural people, 1985 (Ar E F S)
65 Forest legislation in selected African countries, 1986 (E F)
66 Forestry extension organization, 1986 (C E S)
67 Some medicinal forest plants of Africa and Latin America, 1986 (E)
68 Appropriate forest industries, 1986 (E)
69 Management of forest industries, 1986 (E)
70 Wildland fire management terminology, 1986 (E/F/S)
71 World compendium of forestry and forest products research institutions, 1986 (E/F/S)
72 Wood gas as engine fuel, 1986 (E S)
73 Forest products: world outlook projections 1985-2000, 1986 (E/F/S)
74 Guidelines for forestry information processing, 1986 (E)
75 Monitoring and evaluation of social forestry in India – an operational guide, 1986 (E)
76 Wood preservation manual, 1986 (E)
77 Databook on endangered tree and shrub species and provenances, 1986 (E)
78 Appropriate wood harvesting in plantation forests, 1987 (E)
79 Small-scale forest-based processing enterprises, 1987 (E F S)
80 Forestry extension methods, 1987 (E)
81 Guidelines for forest policy formulation, 1987 (C E)
82 Forest products prices 1967-1986, 1988 (E/F/S)
83 Trade in forest products: a study of the barriers faced by the developing countries, 1988 (E)
84 Forest products: World outlook projections – Product and country tables 1987-2000, 1988 (E/F/S)
85 Forestry extension curricula, 1988 (E/F/S)
86 Forestry policies in Europe, 1988 (E)
87 Small-scale harvesting operations of wood and non-wood forest products involving rural people, 1988 (E F S)
88 Management of tropical moist forests in Africa, 1989 (E F P)
89 Review of forest management systems of tropical Asia, 1989 (E)
90 Forestry and food security, 1989 (Ar E S)
91 Design manual on basic wood harvesting technology, 1989 (E F S) (Published only as FAO Training Series, No. 18)
92 Forestry policies in Europe – An analysis, 1989 (E)
93 Energy conservation in the mechanical forest industries, 1990 (E S)
94 Manual on sawmill operational maintenance, 1990 (E)
95 Forest products prices 1969-1988, 1990 (E/F/S)
96 Planning and managing forestry research: guidelines for managers, 1990 (E)
97 Non-wood forest products: the way ahead, 1991 (E S)
98 Timber plantations in the humid tropics of Africa, 1993 (E F)
99 Cost control in forest harvesting and road construction, 1992 (E)
100 Introduction to ergonomics in forestry in developing countries, 1992 (E F I)
101 Management and conservation of closed forests in tropical America, 1993 (E F P S)
102 Research management in forestry, 1992 (E F S)
103 Mixed and pure forest plantations in the tropics and subtropics, 1992 (E F S)
104 Forest products prices 1971-1990, 1992 (E/F/S)
105 Compendium of pulp and paper training and research institutions, 1992 (E)
106 Economic assessment of forestry project impacts, 1992 (E/F)
107 Conservation of genetic resources in tropical forest management – Principles and concepts, 1993 (E/F/S)
108 A decade of wood energy activities within the Nairobi Programme of Action, 1993 (E)
109 Directory of forestry research organizations, 1993 (E)
110 Proceedings of the Meeting of Experts on Forestry Research, 1993 (E/F/S)
111 Forestry policies in the Near East region – Analysis and synthesis, 1993 (E)
112 Forest resources assessment 1990 – Tropical countries, 1993 (E)
113 Ex situ storage of seeds, pollen and in vitro cultures of perennial woody plant species, 1993 (E)
114 Assessing forestry project impacts: issues and strategies, 1993 (E F S)
115 Forestry policies of selected countries in Asia and the Pacific, 1993 (E)
116 Les panneaux à base de bois, 1993 (F)
117 Mangrove forest management guidelines, 1994 (E)
118 Biotechnology in forest tree improvement, 1994 (E)
119 Number not assigned
120 Decline and dieback of trees and forests – A global overview, 1994 (E)
121 Ecology and rural education – Manual for rural teachers, 1995 (E S)
122 Readings in sustainable forest management, 1994 (E F S)
123 Forestry education – New trends and prospects, 1994 (E F S)
124 Forest resources assessment 1990 – Global synthesis, 1995 (E F S)
125 Forest products prices 1973-1992, 1995 (E F S)
126 Climate change, forests and forest management – An overview, 1995 (E F S)
127 Valuing forests: context, issues and guidelines, 1995 (E F S)
128 Forest resources assessment 1990 – Tropical forest plantation resources, 1995 (E)
129 Environmental impact assessment and environmental auditing in the pulp and paper industry, 1996 (E)
130 Forest resources assessment 1990 – Survey of tropical forest cover and study of change processes, 1996 (E)
131 Ecología y enseñanza rural – Nociones ambientales básicas para profesores rurales y extensionistas, 1996 (S)
132 Forestry policies of selected countries in Africa, 1996 (E/F)
133 Forest codes of practice – Contributing to environmentally sound forest operations, 1996 (E)

134 Estimating biomass and biomass change of tropical forests – A primer, 1997 (E)
135 Guidelines for the management of tropical forests – 1. The production of wood, 1998 (E S)
136 Managing forests as common property, 1998 (E)
137/1 Forestry policies in the Caribbean – Volume 1: Proceedings of the Expert Consultation, 1998 (E)
137/2 Forestry policies in the Caribbean – Volume 2: Reports of 28 selected countries and territories, 1998 (E)
138 FAO Meeting on Public Policies Affecting Forest Fires, 2001 (E F S)
139 Governance principles for concessions and contacts in public forests, 2003 (E F S)
140 Global Forest Resources Assessment 2000 – Main report, 2002 (E F S)
141 Forestry Outlook Study for Africa – Regional report: opportunities and challenges towards 2020, 2003 (Ar E F)
142 Cross-sectoral policy impacts between forestry and other sectors, 2003 (E F S)
143 Sustainable management of tropical forests in Central Africa – In search of excellence, 2003 (E F)
144 Climate change and the forest sector – Possible national and subnational legislation, 2004 (E)
145 Best practices for improving law compliance in the forest sector, 2005 (E F R S)
146 Microfinance and forest-based small-scale enterprises, 2005 (Ar E F S)
147 Global Forest Resources Assessment 2005 – Progress towards sustainable forest management, 2006 (E F S)
148 Tendencias y perspectivas del sector forestal en América Latina y el Caribe, 2006 (S)
149 Better forestry, less poverty – A practitioner's guide, 2006 (Ar E F S)
150 The new generation of watershed management programmes and projects, 2006 (E F S)
151 Fire management – Global assessment 2006, 2007 (E)
152 People, forests and trees in West and Central Asia – Outlook for 2020, 2007 (Ar E R)
153 The world's mangroves 1980–2005, 2007 (E)
154 Forests and energy – Key issues, 2008 (Ar C E F R S)
155 Forests and water, 2008 (E F S)
156 Global review of forest pests and diseases, 2009 (E)
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FAO FORESTRY PAPER

Global Forest Resources Assessment 2010

Main report

The Global Forest Resources Assessment 2010 (FRA 2010) is the most comprehensive assessment of the world's forests ever. It covers 233 countries and areas for the period 1990 to 2010. This publication, the main report of FRA 2010, contains country data, contributed by national correspondents and reviewed and collated by FAO, for more than 90 key variables related to the extent, condition, uses and values of forests. Seven core chapters evaluate the status and trends for key aspects of sustainable forest management: extent of forest resources; forest biological diversity; forest health and vitality; productive functions of forest resources; protective functions of forest resources; socio-economic functions of forests; and the legal, policy and institutional framework guiding the conservation, management and use of the world's forests. Based on these results, the report analyses progress being made towards sustainable forest management over the past 20 years, with a series of "traffic lights" indicating where there is cause for optimism and where there is cause for alarm. This report is an essential reference for anyone interested in the status of the world's forests and will support policies, decisions and negotiations in all matters where forests and forestry play a part.

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